>pDRIVE<

Operating instructions

>pDRIVE< MX basic

>pDRIVE< MX plus

>pDRIVE< MX plus-hydro

>pDRIVE< MX multi-basic

>pDRIVE< MX multi-plus

>pDRIVE< MX top

>pDRIVE< MX top-hydro

with software PPL6

Safety Instructions

The following symbols should assist you in handling the instructions:

General information, note exactly!

Dangerous voltages! Danger of life!

Advice, tip!

The requirements for successful commissioning are correct selection of the unit, proper projection and mounting. If you have any further questions, please contact the supplier or call the manufacturer of the unit directly.

Capacitor Discharge!

Before performing any work on or in the unit, disconnect from the mains and wait at least 5 minutes until the D.C. link capacitors have been fully discharged to make sure that the device is no longer live.

Automatic Restart!

With certain parameter settings it may happen that the frequency inverter starts up automatically when the mains supply returns after a power failure. Make sure that no persons and no other equipment is in danger.

Commissioning and Service!

Work on or in the unit must be done only by duly qualified staff and in full compliance with the appropriate instructions and pertinent regulations. Note that a fault may cause potential-free contacts and/or PCBs to carry mains potential. To avoid any risk to humans, obey the regulations concerning "Work on Live Equipment" explicitly.

Terms of delivery:

Our deliveries and services are based on the "General Terms of Delivery of the Austrian Electrical Industries" in the latest edition.

Specifications in this instruction:

We are constantly striving to improve our products and adapt them to the latest technical development. Therefore, we reserve the right to modify the specifications given in this instruction at any time, particular those referring to measures and dimensions. All planning recommendations and connection examples are non-binding suggestions for which we cannot accept any liability, particularly since the regulations to be complied with depend on the type and location of the plant and on the use of the instruments.

Regulations:

It is the user's responsibility to ensure that the instrument and its component parts are used in compliance with applicable regulations. It is not permitted to use these instruments in residential areas without special measures to suppress radio frequency interference.

Patents and trademarks:

Please note that we do not guarantee any connections, instruments or processes described herein to be free from patent or trademark rights of third parties.

Keep this instruction at hand near the unit!

Operating the Frequency inverter

>pDRIVE< MX plus >pDRIVE< MX top

These Operating Instructions describe the functions of the following software:
PPL6 version 8 783 024.00 and higher

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This manual covers the topics operation & parametrization. Detailed information about the topics planning, assembly and connection can be found in the Mounting Instructions, information about the bus connection is provided in the Manuals Profibus PBO1, Interbus GW-IBO1, CANopen GW-CBO1 or DeviceNet GW-DBO1.

Please inform your supplier or insurance company in the case of damage or incomplete delivery. The manufacturer shall not accept responsibility for damage caused during shipment or unpacking.

TOP TEN

for getting started

1 Inspect power wiring:

POWER CABLE - FUSES - DISTANCES

- The mains lines must be connected to the terminals L1/L2/L3. (usually on the left)
- Check the capacity of the mains fuses according to the table in the Mounting Instructions.
- A (pre-mating) auxiliary contact should act on the digital input "pulse enable" if the motor line (terminals U/V/W) has a control element (protection or inspection switch).
- Check if the length of the motor cable complies with the permissible limits, and if the AMF (Output Motor Filter) is integrated (if necessary).

2 Inspect EMC measures:

RFI FILTER - GROUNDING - SCREENING

- Does the mains supply contain a filter that is suitable for this application?
- The motor cable screen must be connected with the filter (filter casing or PE terminal) extensively.
- The screen must be connected with the motor casing on the motor side.
- All low-level control lines (including digital inputs) require screening and must not be laid together with the motor lines.
- The frequency inverter (cubicle) requires extensive grounding in order not to exceed trip limits.

3 Switch on mains voltage and carry out tests:

MAINS VOLTAGE - TESTS - AUXILIARY VOLTAGE

- Are the three phase voltages given and symmetrical? (See instructions in "Working with live lines"!)
- Check and switch on the 1 AC 230 V auxiliary voltage for the **>pDRIVE<** MX **top** inverter.
- Check and switch on the 24 V DC buffer voltage, if the function "Contactor control" is activated.
- Correct parameter B3.05 "Line voltage" for the **>pDRIVE<** MX **plus**.

4 Enter motor data:

NOMINAL POWER - NOMINAL SPEED - NOMINAL CURRENT

- Enter the values for nominal power, nominal current, nominal voltage, nominal frequency and nominal speed from the motor output plate in matrix field B3.
- Adjust the sum of P and I for parallel motors.
- Return to matrix field A1-HOME to save the data (or press the button "Save all parameters to FLASH-Memory" or set parameter A1.00 "Save Backup" to "1 Store Backup" and then back to "0" if you are using the MatriX software).

5 Start autotuning (self-adaptation):

MOTOR VALUES - CABLE RESISTANCE - AUTOTUNING

- Use parameter B4.00 to start automatic tuning of the motor (the motor does not start turning).

  ! Motor(s) must be connected !
  ! Pulse enable signal must exist !
  ! The motor must not rotate !

- The individual measuring cycles can be observed on the display (1 to 4 minutes, depending on motor size).

6 Select a suitable application macro:

APPLICATION MACRO 1 - CONTROL TERMINALS - USER MACRO 2

- The inverter has four pre-settings (macros) for 4 typical drive modes.
- Macro M1 is the default setting (for drives which require a constant torque, e.g. conveyors).
- Select the desired macro using parameter B2.03 "Macro selection".
- Chapter B5 "Short menu" shows the configuration of the control terminals for all application macros.

7 The "key" parameters:

SHORT MENU - PARAMETER - MATRIX FIELD B5

- Matrix field B5 "Short menu" lists the "key" parameters for each application.
- All parameter modifications are automatically included into the list of the "Short menu" and are deleted again, whenever the factory default is reset.
- Thus, the short menu provides a clear overview of all parameter settings.
- All parameter modifications are safely stored automatically after 5 minutes or by switching to matrix field A1-HOME or by using parameter A1.00.

8 Start the drive in local mode:

LOCAL MODE - START/STOP - DISPLAY

- Press the "Local/Remote" key in order to activate the display for local mode (bottom left).
- Press the "Start" key and slowly increase the frequency setting by pressing the "Arrow up" key.
- Check the direction of motor rotation.
- Try different speeds and go to matrix field A2 in order to check the different charges.
- You can adjust the 3 analog displays using parameters A6.00 to A6.02.

9 Remote mode:

REMOTE MODE - CONTROL COMMANDS - ACTUAL VALUES

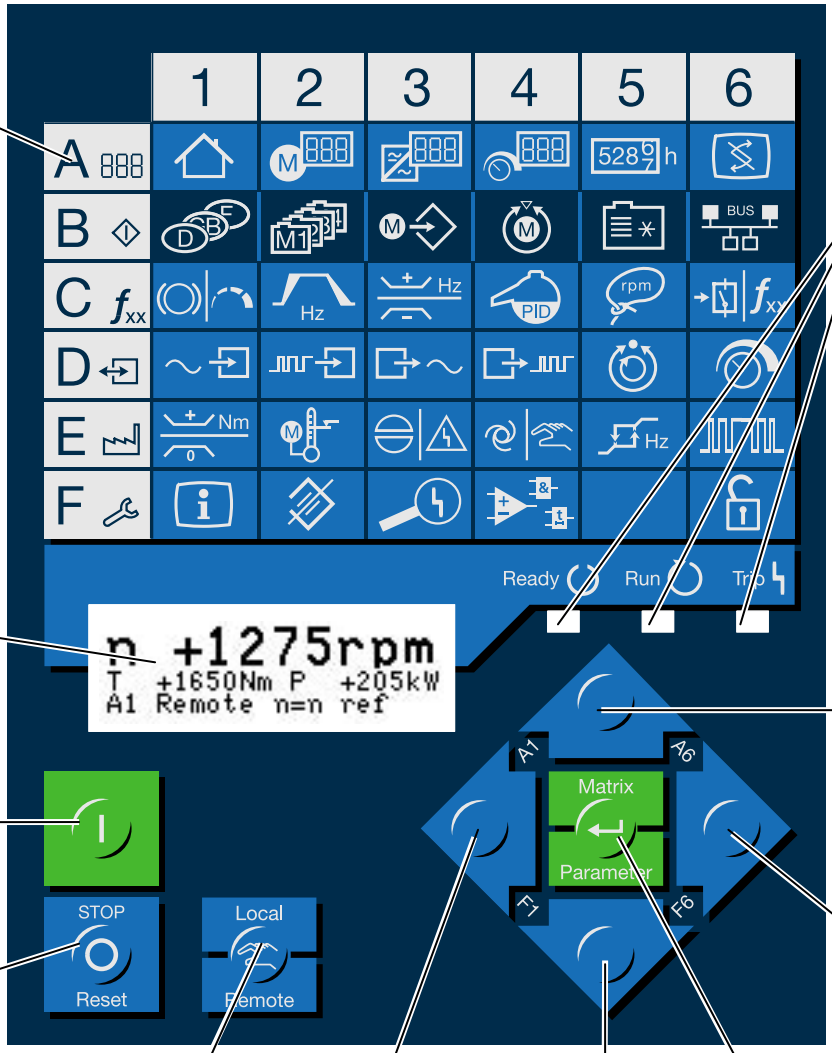
- Check the active reference values and control commands using parameters A4.00 to A4.22 before switching back to remote control mode.
- Activate "Test min. value" or "Test max. value" for the analogue outputs in order to check the actual value feedback sent to the control unit. The relay outputs can also be set to "ON" for testing purposes.
- Switch back to remote control mode, check the power parameters and the reactions to the control commands again.

10 Data storage and protocols:

CODE LOCK - PARAMETER LIST - DATA STORAGE

- Adjust parameters which block unauthorized operating modes:
  - The setting "2 Remote only" for E4.00 and E4.01 blocks the local mode.
  - The code lock has to be lifted before parameters can be adjusted, if a value between 1 and 9999 is selected for F6.01.
- Use B2.01 "Store User-M1" in order to save all parameter values (including motor data) in User Macro 1.
- Manual transfer of all settings from the "Short menu" B5 (+ autotuning data B4.01 to B4.04) to the start-up repord (appendix C of this manual).
- Read-out of all parameters with the PC program "MatriX" in doc-mode and print-out of the whole list (see instructions in appendix B!).

The Keypad



Overview of all matrix fields listed according to their functions

LED status indicators for: ready, operation and trip

Configurable large-format LCD graphic display

"Up" key for: moving on the matrix level, scrolling parameters within a matrix field, increasing numerical values, increasing the reference value in local mode

"ON" key for: Start command in local mode

"OFF" key for: "Stop" command in local or remote mode, selectable reset function

"Right" key for: moving on the matrix level, moving the cursor to the right; selection of forward rotation in local mode

"Local/Remote" key for: mode switch-over: keypad / terminal strip or fieldbus

"Left" key for: moving on the matrix level, moving the cursor to the left; selection of reverse rotation in local mode

"Down" key for: moving on the matrix level, scrolling parameters within a matrix field, decreasing numerical values; decreasing the reference value in local mode

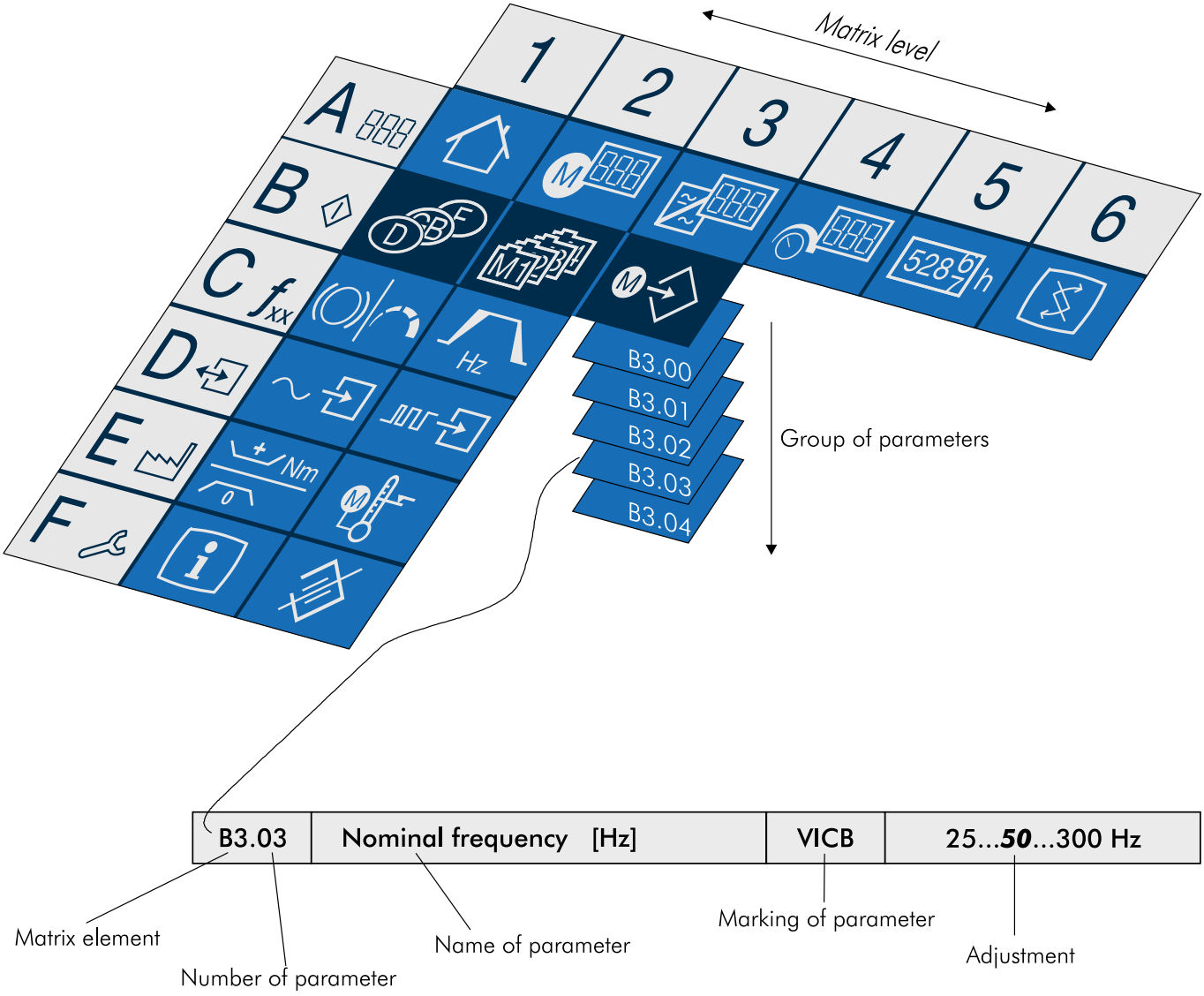
"Matrix/Param." key for: switching between basic display and matrix level, and between matrix level and parameter group; store the new parameter values

The software type and version are shown using parameters A3.08 and A3.09.

When the front cover is removed, the membrane keyboard can easily be removed, rotated by 90° and fixed again. Pay attention to the flat strip cable!

The Matrix Philosophy

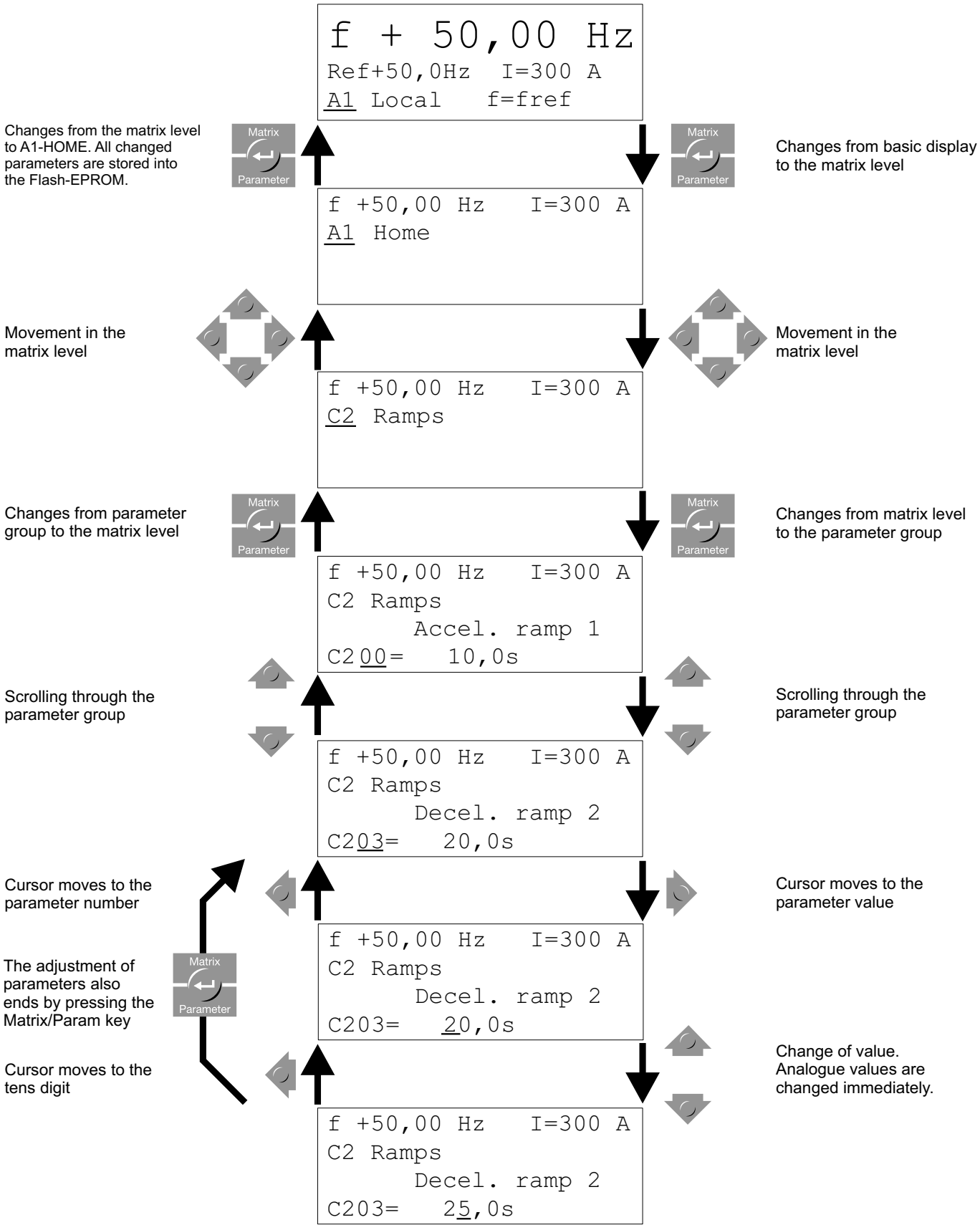
The arrangement of parameters in a matrix system provides the possibility to summarize parameters clearly by using a three dimensional approach.



- Press the key "Matrix/Parameter" to switch from the matrix level to a parameter group and vice versa.
- The matrix field A1-Home has a special function:
  It contains the basic display for the device and parameters which are only accessible with the user software "MATRIX". All modifications are automatically saved when you switch back to the basic display.
- On the matrix level you can select any matrix field by pressing the up, down, left or right arrow keys.

All changes are stored in the FLASH-ROM when you leave the matrix level and switch back to the basic display (A1-HOME) or 5 minutes after modifying a parameter.

Parametrization


f + 50,00 Hz
Ref+50,0Hz I=300 A
A1 Local f=fref
Changes from the matrix level to A1-HOME. All changed parameters are stored into the Flash-EPROM.
Matrix
Parameter
Changes from basic display to the matrix level
f +50,00 Hz I=300 A
A1 Home
Movement in the matrix level
Movement in the matrix level
f +50,00 Hz I=300 A
C2 Ramps
Changes from parameter group to the matrix level
Changes from matrix level to the parameter group
f +50,00 Hz I=300 A
C2 Ramps
Accel. ramp 1
C200= 10,0s
Scrolling through the parameter group
Scrolling through the parameter group
f +50,00 Hz I=300 A
C2 Ramps
Decel. ramp 2
C203= 20,0s
Cursor moves to the parameter number
Cursor moves to the parameter value
The adjustment of parameters also ends by pressing the Matrix/Param key
f +50,00 Hz I=300 A
C2 Ramps
Decel. ramp 2
C203= 20,0s
Cursor moves to the tens digit
Change of value. Analogue values are changed immediately.
f +50,00 Hz I=300 A
C2 Ramps
Decel. ramp 2
C203= 25,0s

Shortcuts

You can move quickly on the matrix level by using the following shortcuts:

To move to the top left (A1 HOME)	Simultaneously press keys ◀ + ▲
To move to the top right (A6 DISPLAY CONFIGURATION)	Simultaneously press keys ▶ + ▲
To move to the bottom left (F1 TEST-HELP)	Simultaneously press keys ◀ + ▼
To move to the bottom right (F6 CODE LOCK)	Simultaneously press keys ▶ + ▼

In this way you can switch from the matrix level to a parameter group at the same time.

Local Mode

Activate the "LOCAL" mode to operate the frequency inverter using the integrated keypad. To do so, go to the basic display and press the key "LOCAL/REMOTE".

During LOCAL mode the keys have following function:

Key	Basic functions	Menu level	Parameter group
I	Start	—	—
STOP Reset	Stop / Reset	Stop / Reset	Stop / Reset
STOP Reset	2 x Stop / Reset	2 x Stop / Reset	2 x Stop / Reset = free wheel
▲	Increase ref. value	Navigating on the matrix level	Scroll parameters or increase parameter values
▼	Reduce ref. value	Navigating on the matrix level	Scroll parameters or decrease parameter values
◀	REV run	Navigating on the matrix level	Cursor left
▶	FWD run	Navigating on the matrix level	Cursor right

The system is automatically restarted after the removal or confirmation of a trip due to a steady Start FWD or Start REV signal on the terminal strip.

Local mode can be blocked with parameters E4.00 to E4.03!

If you use option card IO1, you have to activate the pulse enable using digital input DI5 in order to start the frequency inverter!

The functions of the keys can be connected to the terminal strip with parameter E4.03. As a result, the keys of the keypad have no functions for local mode (Exception: "Stop" key, if parameter E4.04 was set to "1 always active" and if impulse contacts are used for the digital input signal).

Start-up

Follow the steps listed below in order to start up the inverter:

B		**Setup**

B1		**Language selection**	Select the operating language
B2		**Macro configuration**	The selection of an application macro configures the terminal strip and creates a suitable short menu.
B3		**Motor data**	Dual rating is adjusted with the motor data: Version C: high overload Version P: high continuous load
B4		**Auto tune**	A routine is started in order to tune the motor exactly with the inverter.
B5		**Short menu**	Adjustment of the parameters in the short menu.

Matrix	If additional parameters that are not included in the short menu are required to optimize the system, go to the matrix fields and set the necessary parameters accordingly. They are automatically transferred into the short menu.

B2		**Macro configuration**	After starting up the inverter, you can transfer the set parameters to the User Macro by using parameters B2.01 and B2.02.

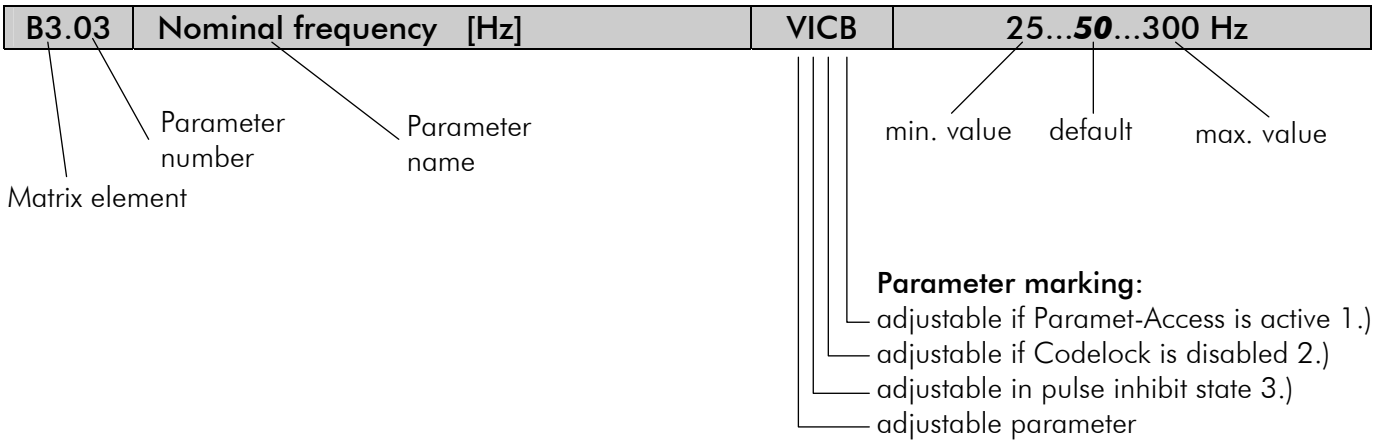
During the start-up phase, it might be helpful to supply the frequency inverter with an external 24 V buffer voltage. This allows you to make adjustments without power supply from the mains (exception: autotuning and default motor data).

The user interface is fully functional when an auxiliary voltage is applied.

Please use the start-up report in the appendix to record the inverter settings.

You should only transfer those parameters to the list that are shown in the short menu. All parameters that are not displayed are still set to the factory defaults.

Description of parameters



1.) See parameter F6.02

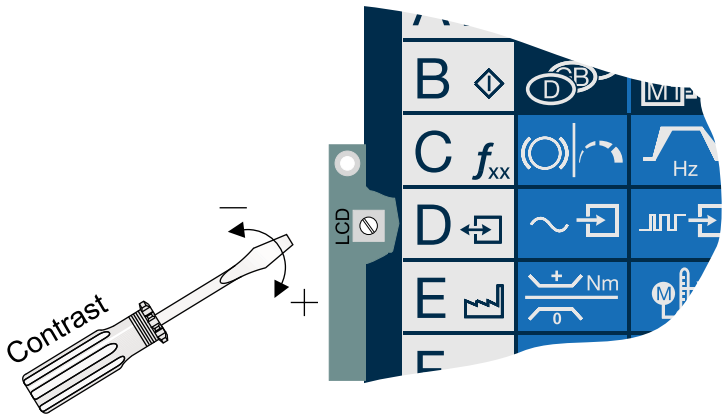
2.) See parameters F6.00 and F6.01

3.) No ON commands are accepted while these parameters are being set.

Key commands are suppressed and steady commands ignored as long as the cursor is positioned right of the "=" sign.

LCD display contrast regulation

There is a potentiometer for regulating the contrast of the LCD display in the top left corner of the PCB (user interface - UI).



A1		Home

Any modifications are stored in the FLASH-ROM:
1.) when leaving the matrix level and switching back to the basic display (A1 HOME) or
2.) five minutes after modifying a parameter.

Operating modes (also displayed in A1.01)	
Disabled	The inverter is blocked (does not emit voltage) because: • there is no enable signal at the terminal strip (digital input DI5_2 or a programmed input) or • because the device states "19 Lock switching on" or "0 Not ready to switch on" are activated for bus control or • parameter C1.02 is set to "0 Free wheel" and a Stop command is given or • parameter F6.03 "Pulse inhibit" is set to "1 Yes".
Stop	The inverter is enabled but there has not been a "START" command.
Not enabled	The internal command "Operation release" is missing (only for BUS control).
Trip	The inverter has been switched off due to a trip and the reason is displayed in the device status field.
Loading	If the function Contactor CTRL is activated, this command shows that the line contactor has been activated but the necessary DC-voltage has not been reached yet.
Mains off	The inverter input terminals L1, L2, L3 have been enabled by a line contactor using the function "Contactor CTRL" (C6.00).
Mains missing	"Mains missing" is displayed if the mains supply fails during operation. If the mains is missing longer than the time set with parameter E3.22 "Undervoltage time delay", the display changes to "Undervoltage".
Mains disconnected	The digital command "Supply ON/OFF" triggers a safety trip.
Local only	Inverter electronics have been blocked for remote operation with the command "Force local". Local mode using the keypad (or terminal strip "Local") is still possible.
Heating Motor	The function "Motor heating" has been activated.
AT running	The function "Auto tune" has been activated.

Displays during parametrization	
Code lock	You are trying to modify a parameter that is subject to Codelock. Remedy: disable Codelock F6!
Para locked	1. You are trying to modify a parameter that is subject to parameter lock. Remedy: Digital input "Paramet-lock" → break contact 2. You are trying to modify a parameter while the switch-over between 2 parameter sets using B2.04 "Multi-configuration" is active. Remedy: Change B2.04 to "0 not active".
Pulse release	You are trying to change a parameter that can only be changed if pulse inhibit is activated. Remedy: Stop command
No access	You are trying to modify a parameter via an unauthorized user terminal. Remedy: Activate "Paramet.-access" for the respective user terminal (F6.02).
Read only	You are trying to change an actual value (display) parameter.

Displays during operation (also displayed in A1.03)	
Acceleration (2)	• The drive accelerates according to the settings for the acceleration ramp. The reference frequency has not been reached yet ($f_{REF} > f_{ACT}$). • An active limitation (thermal motor model, overload of the frequency inverter, etc.) during motor operation decreases the frequency ($f_{REF} > f_{ACT}$). • During motor operation with torque limitation ($f_{REF} > f_{ACT}$).
Deceleration (3)	• The drive decelerates according to the setting for the deceleration ramp. The ref. frequency is not reached yet ($f_{REF} < f_{ACT}$). • An active limitation (thermal motor model, overload of the frequency inverter, etc.) during generator operation increases the frequency ($f_{REF} < f_{ACT}$). • During generator operation with torque limitation ($f_{REF} < f_{ACT}$).
$n = n_{REF}$ (1)	The actual frequency (speed) corresponds with the reference frequency (speed). Hysteresis and delay time can be adjusted using parameter D4.08.
Macro 1 (UM1) (6)	Parameter set1 = User Macro1 As soon as the setting "Parameter set2" has been activated with parameter B2.04, parameter set 1 or 2 is loaded depending on the digital input.
Macro 2 (UM2) (7)	Parameter set2 = User Macro2 If there is a "1"-signal at the respective digital input, the 2nd parameter set (= User Macro 2) is loaded and "Parameter set 2 (UM2)" is displayed.
BU active (11)	The connected braking unit(s) BU is (are) switched on.
Emergency operation (15)	The drive is running in emergency mode.
Alarms	A monitoring system, which is parametrized to "Alarm", has exceeded the set limit (see Appendix A).
Limitations	See Appendix A (are only displayed if A6.03 = 1).

A2 — Motor values

A2.00	Speed [rpm]	—	read only 1.)

Shows the actual motor speed in revolutions per minute. This is also displayed with pulse inhibit, i.e. when the motor is running out freely. Negative values indicate reverse rotation.

A2.01	Torque [Nm]	—	read only

The display is "quadrantal". Display tolerance: ±5% with reference to the nominal torque (friction, iron losses and ventilation losses are not included).
In drives without encoder, the tolerance is higher in frequency ranges up to 2 Hz.

A2.02	Motor load [%]	—	read only

100% correspond to the nominal current of the motor. Display tolerance: ±1.5%

A2.03	Motor current [A]	—	read only

Apparent current of the motor in Ampere. Display tolerance: ±1.5% with reference to $I_{N"C"}$ (effective value of the fundamental oscillation)

A2.04	Shaft power [kW]	—	read only

Display tolerance: ±5% with reference to nominal power (calculated from T and n)

A2.05	Apparent power [kVA]	—	read only

Display tolerance: ±3% with reference to nominal power (calculated from U and I)

A2.06	Motor voltage [V]	—	read only

Display tolerance: ±2% with reference to nominal voltage (effective value of fundamental oscillation)

A2.07	Slip frequency [Hz]	—	read only

Displays the slip frequency calculated from the nominal data of the motor and the actual load (calculated from the torque and the flow).

A2.08	Process speed [m/min]	—	read only 1.)

Possibility to display the process speed in m/min. The necessary conversion factor can be adjusted with parameter A2.10. A2.08 = A2.00 x A2.10.

A2.09	Machine speed [rpm]	—	read only 1.)

Possibility to display the machine speed in revolutions per minute. The gearing factor can be adjusted with parameter A2.11. A2.09 = A2.00 x A2.11.

A2.10	Process scaling	VCB	-10.000...***1.000***...10.000
A2.11	Machine scaling	VCB	-10.000...***1.000***...10.000

A2.12	Thermal state Motor [%]	—	read only

Displays the calculated thermal state of the motor based on the setting of parameters E2.04 to E2.07.

A2.13	Position value LOW	—	read only
A2.14	Position value HIGH	—	read only

The pulses which are registrated by the encoder are summed up to the position value. To increase the resolution, both ramps of the encoder signals A and B are registrated. That is why the position value corresponds to four times of the real pulses (also see parameter D5.03).
The position value is shown hexadecimal in a 32bit word.

4 x Sum of encoder pulses = Position value

Position value 32bit

HIGH	LOW
A2.14	A2.13

The position value can be reset to zero by the digital input "Reset position".

1.) If the power part has no voltage supply ("Mains off" or "Mains missing" is displayed), these actual values are set to 0.

A3 Inverter values

A3.00	Output frequency [Hz]	—	read only

Resolution: 0.01 Hz

A3.01	Inverter load [%]	—	read only

100% correspond to the nominal current of the inverter (Version "C"). Display tolerance: ±1.5%

A3.02	DC bus-voltage [VDC]	—	read only 1.)

Displays the actual DC voltage. Display tolerance: ±2% with reference to the max. DC voltage. If the mains voltage is 400 V, the DC voltage ranges between 540 and 565 V DC.

A3.03	Heatsink temperature [°C]	—	read only 1.)

Display tolerance: ±5% (max. heatsink temperature: 81°C...95°C, depending on size)
Exceeding the limits leads to:

1.) reduction of the switching frequency (see E6)
2.) reduction of the motor current
3.) overtemperature trip.

A3.04	Active switching frequency [kHz]	—	read only
A3.05	Drive reference	—	read only
A3.06	Nominal current "C" [A]	—	read only
A3.07	Hardware version	—	read only
A3.08	Software type	—	read only
A3.09	Software version	—	read only
A3.10	Serial number	—	read only

A3.11	Drive status	—	read only

The drive states are displayed according to the MX status machine.

0 .....Not ready to switch on
1 .....Ready to switch on
2 .....Charge DC-bus
3 .....Ready to run
4 .....Operation release
5 .....Ramp output release
6 .....Ramp release
7 .....Run
8 .....Motor fluxing
9 .....Release brake 1
10 ...Crane active
11 ...Jog 1 active
12 ...Jog 1 break
13 ...OFF 1 (deceleration) active
14 ...OFF 3 (quickstop) active
15 ...Close brake
16 ...DC-brake 1
17 ...DC-brake 2
18 ...OFF 2 (pulse inhibit) active
19 ...Lock switching on
20 ...Fault
21 ...Autotuning in progress
22 ...Power part test in progress
23 ...Release brake 2
24 ...Release brake 3
25 ...Motor heating
26 ...Trip condition 1
27 ...Trip condition 2

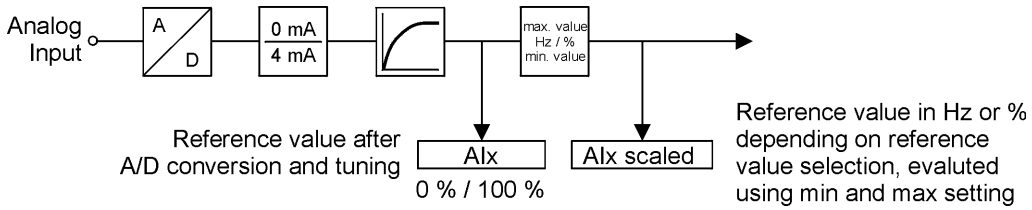
Also see documentation "Option Profibus PBO1", "Option Interbus GW-IBO1", "Option CANopen GW-CBO1" or "Option DeviceNet GW-DBO1" (identical with parameter B6.48).

A3.12	Thermal state BR [%]	—	read only

Displays the calculated thermal state of the braking resistor based on the setting of parameters E3.07 and E3.08. If the value exceeds 100%, an alarm or trip will occur (depends on E3.06).

1.) If the power part has no voltage supply ("Mains off" or "Mains missing" is displayed), these actual values are set to 0.

A4 Reference values



A4.00	AIV 0...10 V [%]	—	read only

Reference value at the analog input terminal AIV (0 V...10 V corresp. to 0% ... 100 %).

A4.01	AIV scaled [Hz] ([%])	—	read only

Scaled reference value of AIV.

A4.02	AIC 0(4)...20 mA [%]	—	read only

Reference value at the analog input terminal AIC (0(4) mA ... 20 mA / 0% ... 100 %).

A4.03	AIC scaled [Hz] ([%])	—	read only

Scaled reference value of AIC.

A4.04	AI_2 0(4)...20 mA [%]	—	read only

Reference value at the analog input terminals (AI+ , AI-) of IO1 at the option slot X2.
(0(4) mA ... 20 mA / 0% ... 100 %)

A4.05	AI_2 scaled [Hz] ([%])	—	read only

Scaled reference value of AI_2.

A4.06	AI_3 0(4)...20 mA [%]	—	read only

Reference value at the analog input terminals (AI+ , AI-) of IO1at the option slot X3.
(0(4) mA ... 20 mA / 0% ... 100 %)

A4.07	AI_3 scaled [Hz] ([%])	—	read only

Scaled reference value of AI_3.

A4.08	Pre-set reference [Hz] ([%])	—	read only

Pre-set reference value.

A4.09	Local reference [Hz] ([%])	—	read only

Reference value of local motorpotentiometer (keys UP, DOWN on keypad or digital commands +speed local and -speed local on terminal strip)

A4.10	Remote reference [Hz] ([%])	—	read only

Reference value of remote motorpotentiometer (digital inputs +speed remote, -speed remote)

A4.11	Frequency before ramp	—	read only

Currently used frequency reference value before the acceleration integrator.

A4.12	Frequency after ramp	—	read only

Currently used frequency reference value after the acceleration integrator.

A4.13	Torque limitation [%]	—	read only

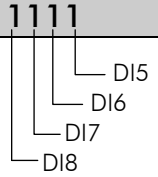
Currently used reference value for torque limitation.

A4.14	Digital input X1	—	read only 1111

This parameter shows the current state ("0" or "1"; in 4 bits) of the digital inputs on the basic card X1: terminals 11 to 14, DI1 to DI4 (from the right to the left).

A4.15	Digital input X2	—	read only 1111

State of the digital inputs at the 1st option card IO1
X2: terminals 26 to 29, DI5_2 to DI8_2 (from the right to the left).



NOTE: DI5_2 will always be set to "1" if there is no option card! → Display: "_ _ _ 1"

A4.16	Digital input X3	—	read only 1111

State of the digital inputs at the 2nd option card IO1
X3: terminals 26 to 29, DI5_3 to DI8_3 (from the right to the left).

A4.17	Drive control word	—	read only

This parameter displays the internal control word of the drive. With the control word the MX Status machine is controlled. Hexadecimal presentation is used for the display.
Further instructions are included in the manuals "Option Profibus PBO1", "Option Interbus GW-IBO1", "Option CANopen GW-CBO1" and "Option DeviceNet GW-DBO1", parameter B6.47.

A4.18	Bus-reference 1 scale	—	read only
A4.19	Bus-reference 2 scale	—	read only
A4.20	Bus-reference 3 scale	—	read only
A4.21	Bus-reference 4 scale	—	read only
A4.22	Bus-reference 5 scale	—	read only

Parameters A4.18 to A4.22 display the BUS reference values (PZD2 to PZD6) as standardized values that are created by reference value destinations.
Further instructions are given in the manuals "Option Profibus PBO1", "Option Interbus GW-IBO1", "Option CANopen GW-CBO1" and "Option DeviceNet GW-DBO1".

A5	5289/7 h	Time / kWh

A5.00	Operating hours motor [h]	—	read only

The operating hours meter "Motor" records the time during which the frequency inverter is in the operating mode "Pulse release"; i. e. voltage is applied to the motor.
(Display is possible by selecting A6.00 to 02!)

If the switch-over to 2 motors B2.04 = "2 Parameterset 1/2 (2 motors)" is used, the operating time of the selected motor is displayed.

A5.01	Operating hours inverter [h]	—	read only

The operating hours meter "Inverter (FI)" records the time during which the frequency inverter is supplied with voltage (including 24V buffer voltage).

A5.02	kWh-meter [MWh]	—	read only

The kWh-meter records how much active energy has been consumed by the motor. Display tolerance: ±3%; Motor power and generator power is recorded (therefore, also a negative value can be displayed).
Display is possible by selecting A6.00 to 02!

A5.03	Power On hour [h]	—	read only

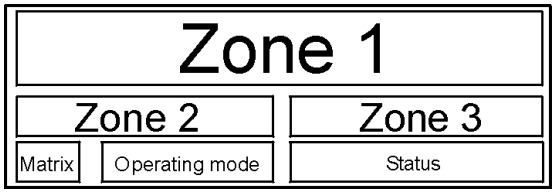
The "Power On hour"-meter records the time during which the inverter is connected to mains supply (and the fan(s) is (are) running).

Operating hours meter, the counter of Power ON hours and kWh-meter cannot be reset by parametrization!

A5.04	Maintenance at	VB	0.0...***0.0***...999999 h

The drive will create an alarm message (indicated on display; part of "Alarm 1" and part of "Alarms") when A5.03 "Power On hour" gets higher than the value set with this parameter. This alarm message can be used, for example, as an information when the fans should be replaced.
This function is not active, if the value is set to zero.

A6 Display configuration



You can assign an analog reference or actual value to each zone (1, 2 and 3) by using the following selection table.

Zone 2 is not displayed during parametrization and zone 1 is minimized !

A6.00	Selection of zone 1	VCB	Output frequency
A6.01	Selection of zone 2	VCB	Speed reference
A6.02	Selection of zone 3	VCB	Motor current

0 ... Output frequency	Hz •	corr. to A3.00
1 ... Inverter load	% of nominal inverter current "C"	corr. to A3.01
2 ... Motor load	% of nominal motor current	corr. to A2.02
3 ... Torque	Nm	corr. to A2.01
4 ... Motor voltage	V	corr. to A2.06
5 ... Motor current	A •	corr. to A2.03
6 ... Shaft power	kW	corr. to A2.04
7 ... Apparent power	kVA	corr. to A2.05
8 ... Motor speed	rpm	corr. to A2.00
9 ... Process speed	m/min	corr. to A2.08
10 . Machine speed	rpm	corr. to A2.09
11 . Speed reference	Hz •	corr. to A4.11
12 . Torque reference	%	corr. to A4.13
13 . PID reference value	%	corr. to C4.00
14 . PID feedback	%	corr. to C4.01
15 . PID error	%	corr. to C4.02
16 . DC voltage	V	corr. to A3.02
17 . Operating hours motor	h	corr. to A5.00
18 . kWh meter	MWh	corr. to A5.02
19 . Power On time	h	corr. to A5.03
20 . Thermal state Motor	%	corr. to A2.12
21 . Thermal state BR	%	corr. to A3.12
22 . Autotuning current	A (not for A6.01)	corr. to B4.05

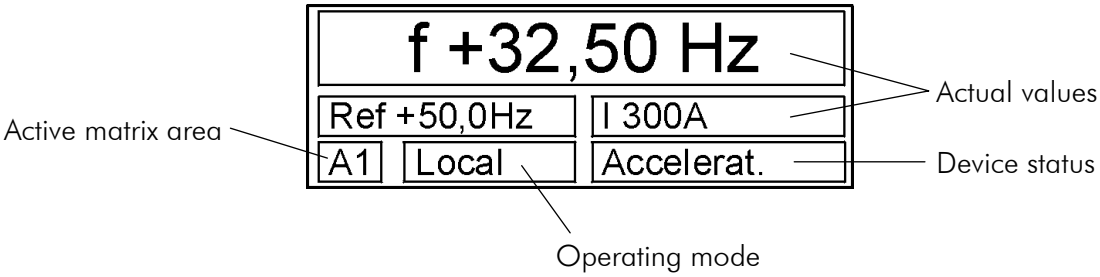
A6.03	View limitation	VCB	not visible

0 ... not visible •
1 ... visible

If this parameter is set to 1, limitation interventions like "Motor temperature", etc. (see Appendix A) are displayed in the status field. The display lasts as long as the intervention is ongoing, but at least 1.5 seconds.
Also the function of the braking unit *BU plus* (ON command "BU active") is displayed.
This parameter is especially useful when starting up the inverter and during maintenance.

Basic display

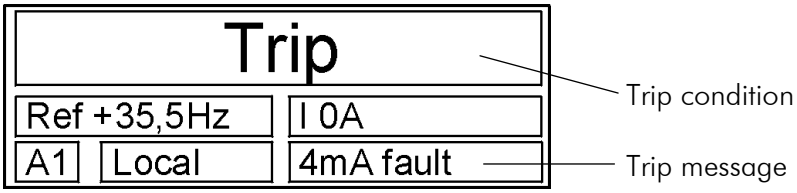
This matrix area shows the basic display of the frequency inverter. Three actual values, the operating mode, device status and the active matrix field are displayed.



All analog values displayed can be configured freely in matrix field A6 (Display configuration).
Any parameter changes are transferred to the memory as soon as the function HOME is activated again.

Trip messages

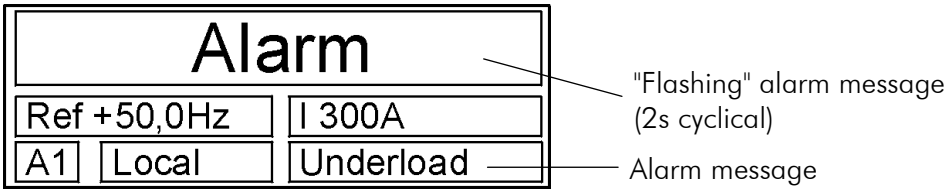
In the event of a trip, the inverter switches off by means of pulse inhibit. A stored Start command (local control or start impulse contact) is deleted. The error message is issued as an entry in the status field.



All trip messages are listed in Appendix A.
More information about the cause of the trip and possible troubleshooting measurements for each trip message can be found in matrix area F1-Help.

Alarm messages

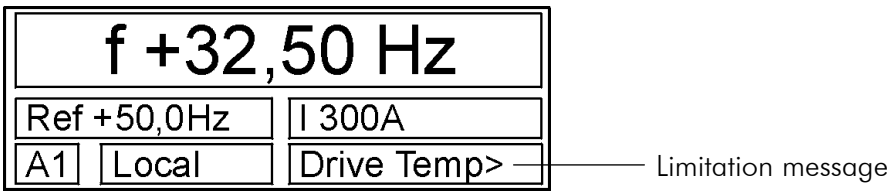
For an alarm message the big display zone 1 is cyclical switched-over. Thereby, a "flashing" alarm message results.



An alarm message needs not to be reseted ! All alarm messages are listed in Appendix A.

Limitation messages

If A6.03 "View limitation" is set to "1 visible", limitation interventions like "Current limitation", etc. are displayed in the status field. The display lasts as long as the intervention is ongoing, but at least 1.5 seconds.



All limitation messages are listed in Appendix A.

B1 Language selection

B1.00	Select language	VCB	German

	Software:	PPL6_A1	PPL6_A2	PPL6_A3	PPL6_A4
0 ... German •		yes	yes	yes	–
1 ... English		yes	yes	yes	yes
2 ... French		yes	yes	yes	–
3 ... Netherlands		yes	–	–	–
4 ... Polish		–	yes	–	–
5 ... Czech		–	yes	–	–
6 ... Italian		–	–	yes	–
7 ... Spanish		yes	–	yes	–
8 ... Russian		–	–	–	yes
9 ... Bulgarian		–	–	–	yes

This parameter is not adjusted in the case of factory default!

B2 Macro configuration

B2.00	Macro selected	—	read only

This parameter displays which macro was selected last.
In the case of user macros, the display also indicates from which factory macro they were derived.

B2.01	Store User-Macro 1	VCB	Routine
B2.02	Store User-Macro 2	VCB	Routine

0 ... Start → 1 The storage routine is activated by changing to line 1.
1 ... Store
2 ... Stored

All parameter adjustments can be transferred to the customer-specific "USER macro" by using this storage process (user-programmable default values). Often it can be useful to store parameter adjustments in several steps and thus to make the process of starting up the drive or the whole system easier.

The motor data (Areas B3 and B4) are also stored!

SAFETY NOTE:
After successful start-up of the drive, all parameters should be stored in user macro 1 or 2. This allows you to restore all parameters with B2.03 (including the motor data and autotuning values) in the event of a replacement of the power part.

B2.03	Macro selection	VICB	Conveyor

0 .... Conveyor •	Macro M1 (page 27)	
1 .... Piston pump	Macro M1 (page 27)	
2 .... Centrifugal pump	Macro M2 (page 30)	
3 .... Coiler	Macro M4 (page 38)	The existing parameter settings (<u>but not the motor data</u>) are overwritten with the respective pre-settings.
4 .... Test bench	Macro M4 (page 38)	
5 .... Pump + PID	Macro M3 (page 34)	
6 .... Exhaust fan	Macro M2 (page 30)	
7 .... Fan	Macro M2 (page 30)	
8 .... Separator	Macro M1 (page 27)	
9 .... User-Macro 1 *10 .. User-Macro 2*	The existing parameter settings (incl. motor data B3 and B4) are overwritten with the values from storage location (UM1 and UM2).	
11 .. no change	Exits the parameter without modifications.	

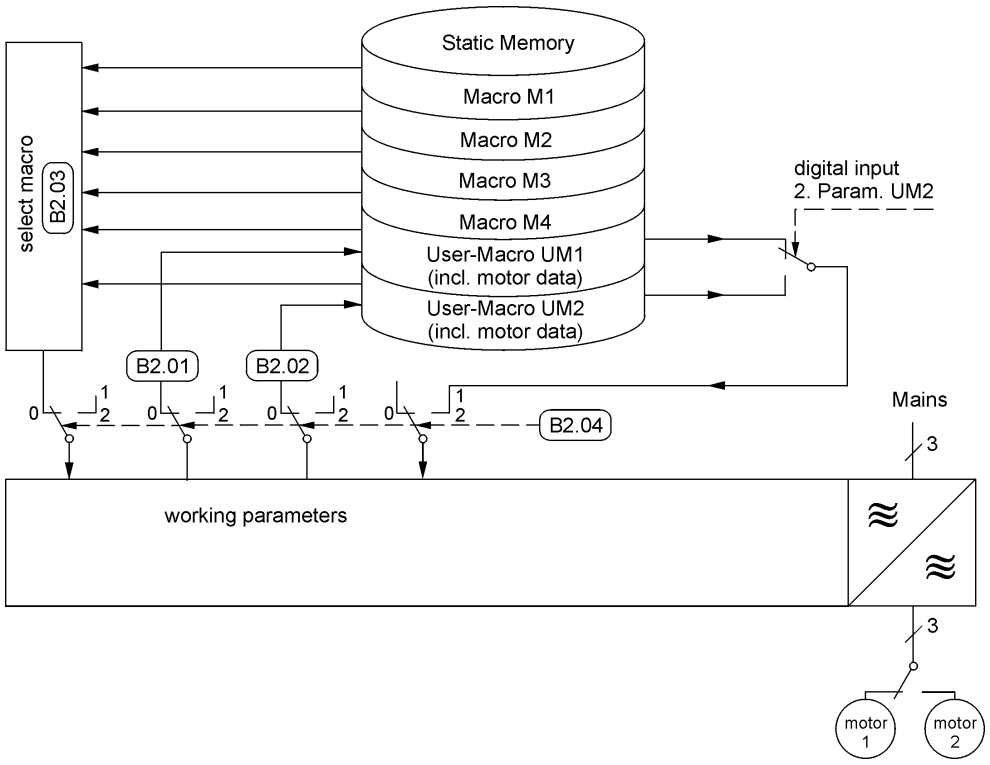
To make adaptation of the frequency inverter to the respective application as simple as possible, the library contains a number of application macros. Selecting a macro automatically activates the suitable functions, optimizes parameters and configures the terminal strip. At the same time a "Short menu" is created; it contains only those parameters that are important for the selected application. For comprehensive descriptions of the macros, see "B5-Short menu".

CAUTION:
The factory defaults of User Macros 1and 2 (state of delivery) do not contain any motor data!
Use F2.01 to load the factory motor data, make adjustments and start autotuning!

B2.04	Multi-configuration	VCB	not active

0 ... not active •	
1 ... Parameter set 1/2 (1 motor)	Application with one motor (thermal motor protection).
2 ... Parameter set 1/2 (2 motors)	A separate motor protection model is provided for each motor (thermal motor protection).

Depending on the position of the digital input (parametrization: "20 User Macro 2"), the parameters are loaded from User Macros 1 or 2.



1.) Load the desired macro for the first motor, adjust the motor data, start autotuning and make all desired parameter adjustments.
2.) Parametrize a digital input (parameter D2.00 to 10) for the position "20 User Macro 2".
3.) Use B2.01 to store the new settings in User macro 1.
4.) Connect the second motor, adjust the motor data, start autotuning and make all desired parameter adjustments.
5.) The same input must be parametrized for the function "20 User Macro 2"!
6.) Use B2.02 to store the new settings in User macro 2.
7.) Set parameter B2.04 to "1 Parameter set 1/2 (1 motor)" or "2 Parameter set 1/2 (2 motors)" and change to the basic display (A1 - Home).
8.) Depending on the signal at the digital input, the respective parameter set is copied into the block "working parameter" in the case of pulse inhibit (Stop, Mains off or Disabled).

    The current parameter set is displayed.

    Digital input Low = User-Macro 1 Display: "Macro 1 (UM1)"
    Digital input High = User-Macro 2 Display: "Macro 2 (UM2)"
9.) Set parameter B2.04 to "0" if you want to adjust further parameters in a particular parameter set; make the desired adjustments and store them with B2.01 and B2.02.
    Then parametrize B2.04 again as "1" or "2".

As soon as B2.04 has the setting 1 or 2, the function "Para locked" will be active, i.e. parameters can no longer be changed!

B3 — Motor data

B3.00	Nominal power [kW]	VICB	0,0...***Default***...2500,0 kW
B3.01	Nominal current [A]	VICB	0,0...***Default***...2500,0 A
B3.02	Nominal voltage [V]	VICB	0...***Default***...1000 V
B3.03	Nominal frequency [Hz]	VICB	25...***Default***...300 Hz
B3.04	Nominal speed [rpm]	VICB	0...***Default***...18000 rpm

By default, the settings for these parameters correspond to a four-pole standard motor for 400 V with the same output as the inverter. If you use a motor with different electrical data, please adjust the parameters (e. g. use of the device as version "C" - high overload).

E.g. for a motor (230/400 V, 22 kW, 50 Hz) in Δ with a constant torque of up to 87 Hz, the parameters have to be adjusted as follows:

$$B3.00 = P_{N,Motor} \cdot \sqrt{3} = 22kW \cdot \sqrt{3} = 38.1kW$$

$$B3.01 = I_{N\Delta(230V)} = 80A$$

$$B3.02 = U_{NY} = 400V$$

$$B3.03 = f_N \cdot \sqrt{3} = 50Hz \cdot \sqrt{3} = 87Hz$$

$$B3.04 = n_N \cdot \sqrt{3} = 1460rpm \cdot \sqrt{3} = 2530rpm$$

The nominal speed entered must be smaller than (or equal to) the synchronous speed! Otherwise, the inverter will calculate the wrong number of pairs of poles and the value displayed as actual speed will be incorrect.

B3.05	Line voltage	VICB	Default: 500 V; 50 Hz for *MX plus* 690 V; 50 Hz for *MX top*

	for line voltage:
0 ... 400 V; 50/60 Hz	3 AC 400V (380...415V ± 10%), 50/60Hz ±5%
1 ... 440 V; 50/60 Hz	3 AC 440V ± 10%, 50/60Hz
2 ... 460 V; 50/60 Hz	3 AC 460V (460...480V ± 10%), 50/60Hz
3 ... 500 V; 50 Hz •	3 AC 500V + 10% - 15%, 50Hz
4 ... 690 V; 50 Hz	3 AC 690V ± 10%, 50Hz

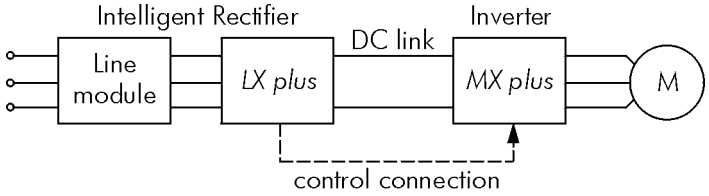
At *>pDRIVE< MX plus* devices the parameter must be set in accordance with the line voltage.
An incorrect setting will lead to a trip during operation or, in the event of a strong mains decrease, even to damage of the input rectifier). With the adjustment of the voltage, the respective nominal drive current is also adjusted (see Mounting Instructions "Notes on Power Supply").

At *>pDRIVE< MX top* devices position 4 is always displayed.

This parameter is not changed by factory default!

B3.06	Operation with IR	VICB	no

0 ... no •	Standard setting for 3 AC mains supply.
1 ... yes	Setting for operation with Intelligent Rectifier *LX plus*.
2 ... depending on DI	Setting depends on a digital input signal selected in matrix area D2.



Only if this parameter is set to position "1 ... yes", the control connection between Intelligent Rectifier *LX plus* and inverter can be cancelled. Otherwise the charging resistors may be damaged !

The adjustment of B3.05 "Line voltage" according to the 3 AC line voltage of the Intelligent Rectifier *LX plus* is absolutely necessary !

The option *>pDRIVE< LX plus* is used to feed the braking energy back to mains, to get sine-shaped mains current and cos φ = 1.

B3.07	Inertia J	VCB	0.0...***1.0***...1000 kgm^2

The adjustment of the moment of inertia J is only necessary for the functions "Fast speed" C6.11...C6.14.

B3.08	Sine Motor filter	VICB	not used

0 ... not used •	(activate "0...not used" for AMF output motor filter!)
1 ... used	

The option SFB (speed feedback) cannot be used if the option SMF (sine motor filter) is activated!

If an AMF (Output-Motor-Filter) is used, this parameter must not be set to "1 ... used" !

B3.09	Heating current	VCB	1...***15***...50 %

With this parameter a heating current can be set in % of the nominal motor current. Thereby the motor is heated during standstill and thus e.g. prevents creation of condensation water.

B4 Auto tune

B4.00	Start tuning	VICB	Routine

0 ... Start 0 → 1	Starts tuning by selecting line "1".
1 ... Autotuning	Autotuning starts and is carried out automatically.
2 ... Rotor coefficient	The rotor coefficient is calculated.
3 ... Rotor constant	The rotor-time constant is calculated.
4 ... Stator resistor	The resistor of motor and motor cable is measured.
5 ... I-flux 1	The necessary fluxing current (no-load current) is
6 ... I-flux 2	calculated in five steps.
7 ... I-flux 3	
8 ... I-flux 4	
9 ... I-flux 5	
10 . O.K.	Autotuning is finished and the calculated values and measurements have been transferred to parameters B4.01 to B4.04.
11 . Cancel	Press the "Stop" key if you want to stop autotuning although the process has not finished yet.

The motor is loaded with different voltages and currents during the autotuning routine, **but it does not start**. Thereby, specific motor measurements are carried out, and the results are stored in parameters B4.01 to B4.04.
The complete autotuning process takes 1 to 4 minutes. For autotuning the motor has to be cold.

1.) **The tuning requires pulse enable for the inverter; i. e. "Stop" or "Mains off" must be displayed!**
2.) **The motor must not rotate during the autotuning process!**

The most accurate measurement results are achieved if the electronic system has operating temperature, i.e. mains voltage should be applied to the inverter for at least 2 minutes prior to autotuning.

Open the plug-in connections X16, X18 between the inverter and the sine motor filter during the autotuning process, if you are using the option SMF (sine motor filter)!!

There are several reasons for error messages that are issued after the autotuning process:

Message	Possible cause
"12 Error: rotor coeff."	– no enable signal at the terminal strip (e.g. digital input DI5) or via the bus – no motor connected
"13 Error: rotor time const."	– motor is too big
"14 Error: stator R"	– no motor connected
"15 Error: I-flux"	– motor parameters (B3.00 to 04) have not been entered correctly – motor rotates

If you cannot operate the motor satisfactorily (e. g. very small motors or special machines), you can reset the factory defaults for the autotuning data:

Use F2.01 "Return factory motor" in order to reset the factory defaults in areas B3 and B4. All the other parameter adjustments and the user macros remain unchanged.

The autotuning values must be stored in the user macro again!

B4.01	Rotor coefficient	VICB	0...***Default***...999999
B4.02	Rotor-time constant	VICB	0.000...***Default***...4.000 s
B4.03	Stator resistor	VICB	0.00...***Default***...50000.00 mOhm
B4.04	Fluxing current	VICB	0.0...***Default***...2500.0 A

After delivery (or after using F2.01 for resetting the factory defaults), the parameters display typical values for a motor according to the "P" power of the inverter. These values are replaced by the new data as soon as the autotuning process has finished.
You can also correct the values → see Service Manual.

B4.05	Autotuning current [A]	—	read only

You can display the current supply during autotuning for inspection purposes.
→ See also parameters A6.00 and A6.02.

B5 Short Menu

A selection of parameters which are important for the chosen application is displayed in this matrix area depending on the macro you have selected.

For many applications, parametrization of the drive will be finished as soon as the parameters displayed in the short menu have been set or adjusted.
You can make further optimizations, e.g. use option cards or different additional inverter functions, by selecting and adjusting the necessary parameters on the matrix level. These modified parameters will also be transferred into the short menu.
The automatic enlargement of the short menu gives you a clear and precise summary of all parameter settings.
All parameters that are not listed in the short menu are stored as factory defaults.

B5 Short menu
C1.00 Incr. start torque
C1.16 Economy mode
C2.00 Accel. ramp 1
C2.01 Decel. ramp 1
C3.00 Min. frequency

e.g. changing parameter C1.02

C1.02 Stop mode	Decel. ramp

→ 0 ... free wheel
1 ... deceleration ramp
2 ... fast stop

leads to the following changes compared with the default:

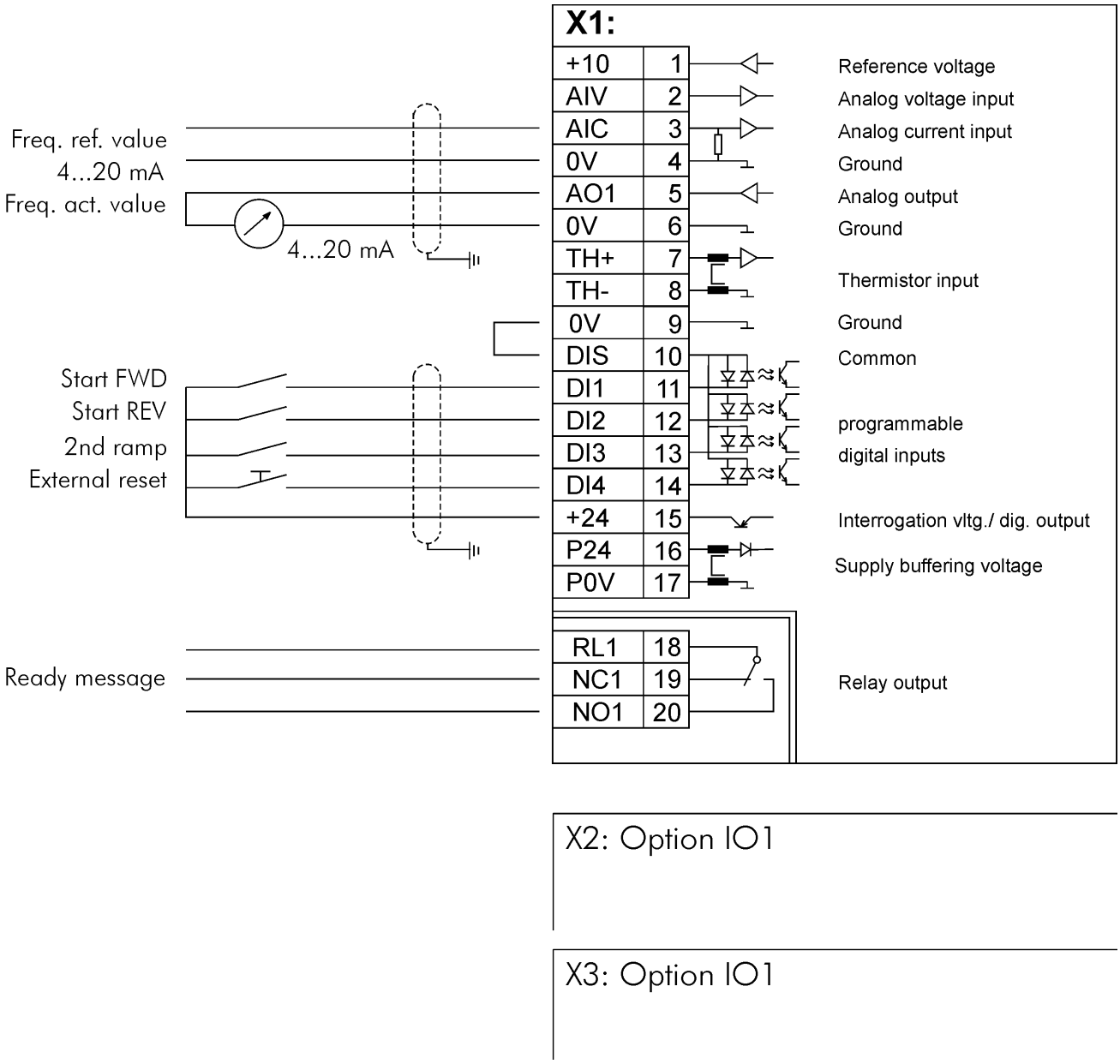
B5 Short menu
C1.00 Incr. start torque
C1.02 Stop mode
C1.16 Economy mode
C2.00 Accel. ramp 1
C2.01 Decel. ramp 1
C3.00 Min. frequency

Macro M1 - Drives with high overload (factory setting)

Conveyors
piston pumps
crane drives
separators, etc.

The start torque can be increased to a maximum of 180% for heavy starts (parameter C1.00 "Increase start torque").
The reference value of 4-20 mA is remote controlled, local mode is operated using the keypad.
Two switches (Start FWD and Start REV) are used for device control; in addition, the terminal strip functions "2. ramp" and "External reset" are programmed.
If you want to make further device-specific adjustments, use the parameter description and make adjustments in the matrix area.
The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M1

Parameter	Name	Setting	Notes
B2.03	Macro selection	Conveyor	or: piston pump, separator
C1.00	Increase start torque	0...***1***...30 %	Setting for 150% start torque
C2.00	Acceleration ramp 1	0.0...***5.0***...3200.0 s	Setting in s/nom. motor frequency
C2.01	Deceleration ramp 1	0.0...***5.0***...3200.0 s	Setting in s/nom. motor frequency
C3.01	Maximum frequency	25.00...***50.00***...300.00 Hz	Setting of the upper frequency limit
C3.02	Direction enable	Enable FWD/REV	Enables forward and reverse rotation
D1.04	AIC selection	f-ref Auto	Frequency ref. value at ref-input AIC (mA)
D1.06	AIC value 0%	-300.00...***0.00***...300.00 Hz	Defines the frequency range for the analog signal 4-20 mA
D1.07	AIC value 100%	-300.00...***50.00***...300.00 Hz	
D2.00	DI1 selection	Start FWD	Start/Stop forward (steady contact)
D2.01	DI2 selection	Start REV	Start/Stop reverse rotation (steady contact)
D2.02	DI3 selection	2.ramp	Changes to 2. accel./decel. ramp set
D2.03	DI4 selection	External Reset	Integration of an external reset
D3.00	AO1 selection	|Output frequency|	Analog output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D4.01	Relay output 1	Ready + Run	Ready message at digital output RL1
E2.00	Thermistor input Act.	not active	
E2.04	I_{MAX} at 0 Hz	0...***50***...150 %	Definition of the motor protection Currents in % with ref. to $I_{NOM,MOTOR}$
E2.05	I_{MAX} at f_{NOM}	30...***100***...150 %	
E2.07	Motor-time constant	1...***5***...3200 min	>5 min: 24V buffering necessary!

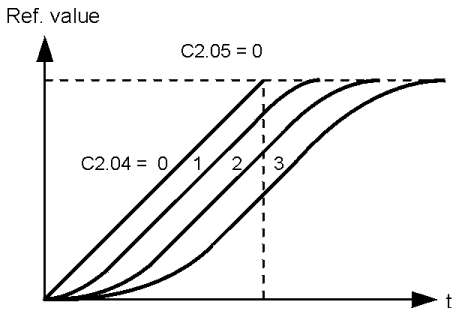
All motor data B3.00 to B3.04 are displayed in the short menu!

For the *>pDRIVE< MX plus*, the short menu also lists parameter B3.05 "Line voltage".

Supplement to macro M1

S-ramp for acceleration and deceleration

You can activate an s-ramp in order to ensure a smooth transition from the standstill of the drive to the acceleration or deceleration phase and from the acceleration/deceleration phase to a steady-state speed.



In addition to macro M1, you have to make the following parameter adjustments:

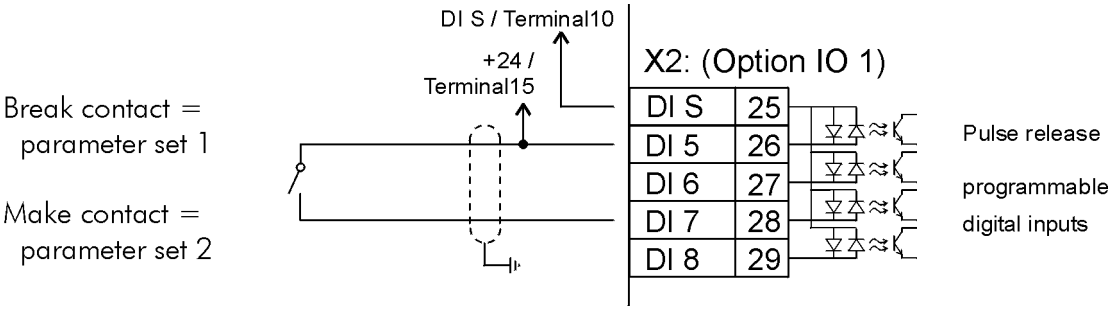
Parameter	Name	Setting	Notes
C2.04	S-ramp	S-ramp step 1, 2 or 3	Make adjustments as required.
C2.05	S-ramp mode	Begin + End	You can also select "Begin only".

Switching to parameter set 2

A special feature of the *>pDRIVE< MX* inverter is that you can have two different settings for every parameter. The set motor values, the measured autotuning values and the optimized parameter values are stored at the locations "User Macro 1" and "User Macro 2". Depending on the digital input, the inverter will operate with parameter set 1 or 2.

Applications:

- The inverter is alternately used for two motors.
- Parametrization for two different working processes with one motor.
- Alternate operation with and without encoder feedback.



Parameter	Name	Setting	Notes
D2.05	DI7_2 selection	User Macro 2	Assignment of the function to DI7_2
B2.01	Store User-M1	Start routine with 1	Select line 1 to initiate the storage process
B2.02	Store User-M2	Start routine with 1	
B2.04 *)	Multi-configuration	Para.Set 1/2 (1 motor)	or Para-Set 1/2 (2 motors)

*) Parameter adjustments are blocked as soon as the parameter is in position 1 or 2.

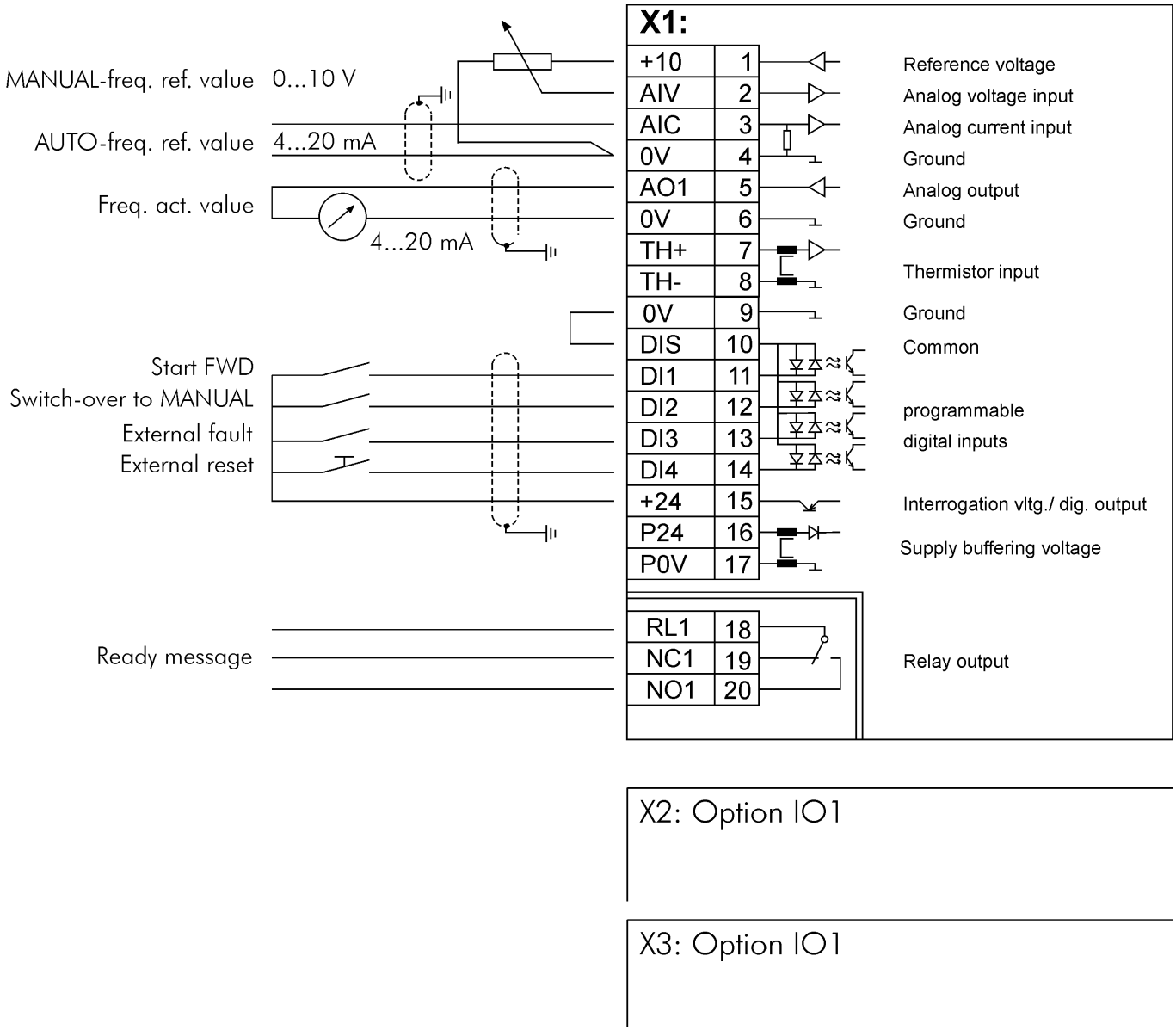
For instructions on the correct setting process, see parameter B2.04.

Macro M2 - Drives with high steady load (n^2 - load moment)

Centrifugal pumps
exhaust fans
fans, etc.

You can change to the higher rated motor power "P" by adjusting the respective motor data in parameters B3.00 to B3.01.
The energy saving function "Economy mode" is activated at step 1. The frequency reference value is set using 2 analog inputs. The 0-10 V input is active, if the switch "Manual (Auto)" is closed. Otherwise, the default values are transmitted via the current reference value input AIC.
The devices are controlled with Start FWD, reverse rotation is blocked. In addition, the terminal strip functions "External fault" and "External reset" are programmed.
If further device-specific adjustments are necessary, please use the parameter description and adjust the parameters via the matrix area. The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M2

Parameter	Name	Setting	Notes
B2.03	Macro selection	Centrifugal pump	or: exhaust fan, fan
C1.16	Economy mode	Step 1	Energy saving mode, step 1
C2.00	Acceleration ramp 1	0.0...***10.0***...3200.0 s	Setting in s/nom. motor frequency
C2.01	Deceleration ramp 1	0.00...***10.0***...3200.0 s	Setting in s/nom. motor frequency
C3.00	Minimum frequency	0.00...***5.00***...300.00 Hz	Setting of the lower frequency limit
C3.01	Maximum frequency	25.00...***50.00***...300.00 Hz	Setting of the upper frequency limit
D1.00	AIV selection	Frequency ref Manual	Manual frequency reference value as 0...10 V signal at analog input AIV
D1.01	AIV value 0 %	-300.00...***0.00***...+300.00 Hz	Defines the frequency range for the analog signal 0...10 V
D1.02	AIV value 100 %	-300.00...***50.00***... +300.00 Hz	
D1.04	AIC selection	Frequency ref Auto	Automatic frequency ref. value as 4-20 mA signal at analog input AIC
D1.06	AIC value 0 %	-300.00...***0.00***...+300.00 Hz	Defines the frequency range for the analog signal 4-20 mA
D1.07	AIC value 100 %	-300.00...***50.00***... +300.00 Hz	
D2.00	DI1 selection	Start FWD	Start/Stop (forward only - steady contact)
D2.01	DI2 selection	Manual (Auto)	Change to manual f-ref. value
D2.02	DI3 selection	External fault	Integration of an external fault
D2.03	DI4 selection	External reset	Integration of an external reset
D3.00	AO1 selection	|Output frequency|	Analog output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D4.01	Relay output 1	Ready + Run	Ready message at digital output RL1
E1.00	Current max. value	125 %	I_{MAX} - limitation with reference to $I_{N"C"}$
E2.00	Thermistor input Act.	not active	
E2.05	I_{MAX} at f_{NOM}	30...***100***...150 %	Definition of the motor protection. Currents in % with ref. to $I_{NOM,MOTOR}$
E2.07	Motor-time constant	1...***5***...3200 min	>5 min: 24 V buffering necessary!
E3.11	External fault Activat.	N.O. Ready + Run	Ext. fault is integrated by means of a make contact and monitored in ready + run mode

All motor data B3.00 to B3.04 are displayed in the short menu!

For the >*pDRIVE*< *MX plus*, the short menu also lists parameter B3.05 "Line voltage".

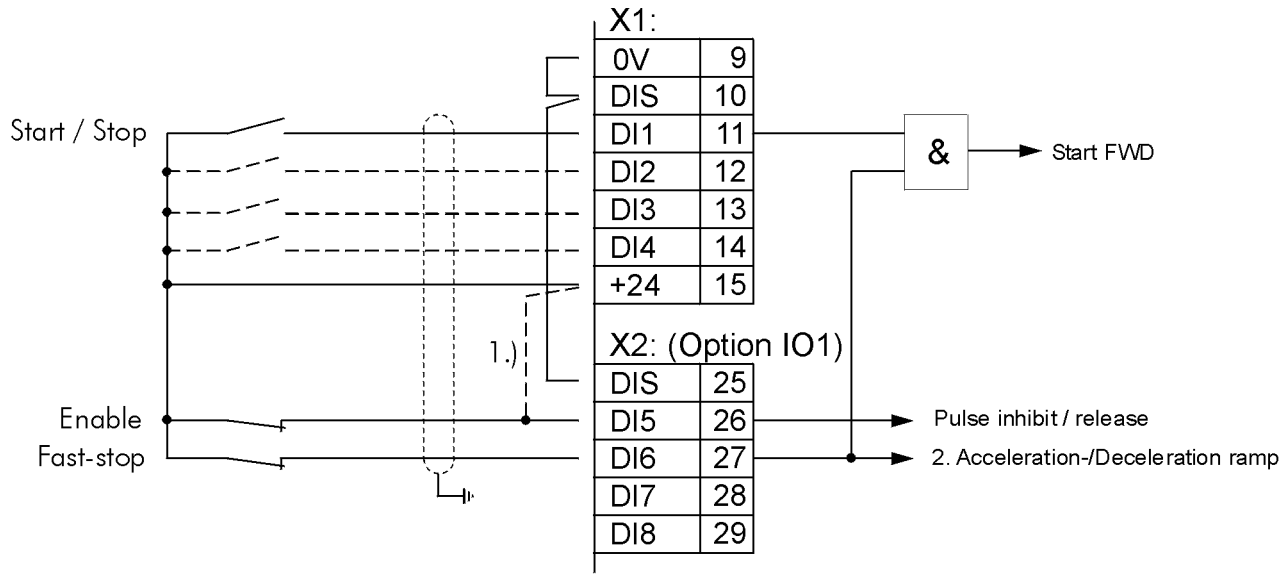
Supplement to macro M2

Fast-Stop with motor brake

Fans often require a fast-stop mechanism for special operating situations. The new motor brake function of the *>pDRIVE< MX* is able to reduce the deceleration time to 10...20%.

Three digital inputs regulate the behavior if the "OFF" command is activated:

DI1	Start FWD at acceleration ramp 2 / OFF 1	Deceleration at deceleration ramp 2
DI5_2	Start FWD at acceleration ramp 2 / OFF 2	Pulse inhibit = free wheel
DI6_2	Start FWD at acceleration ramp 2 / OFF 3	Fast-stop at deceleration ramp 1

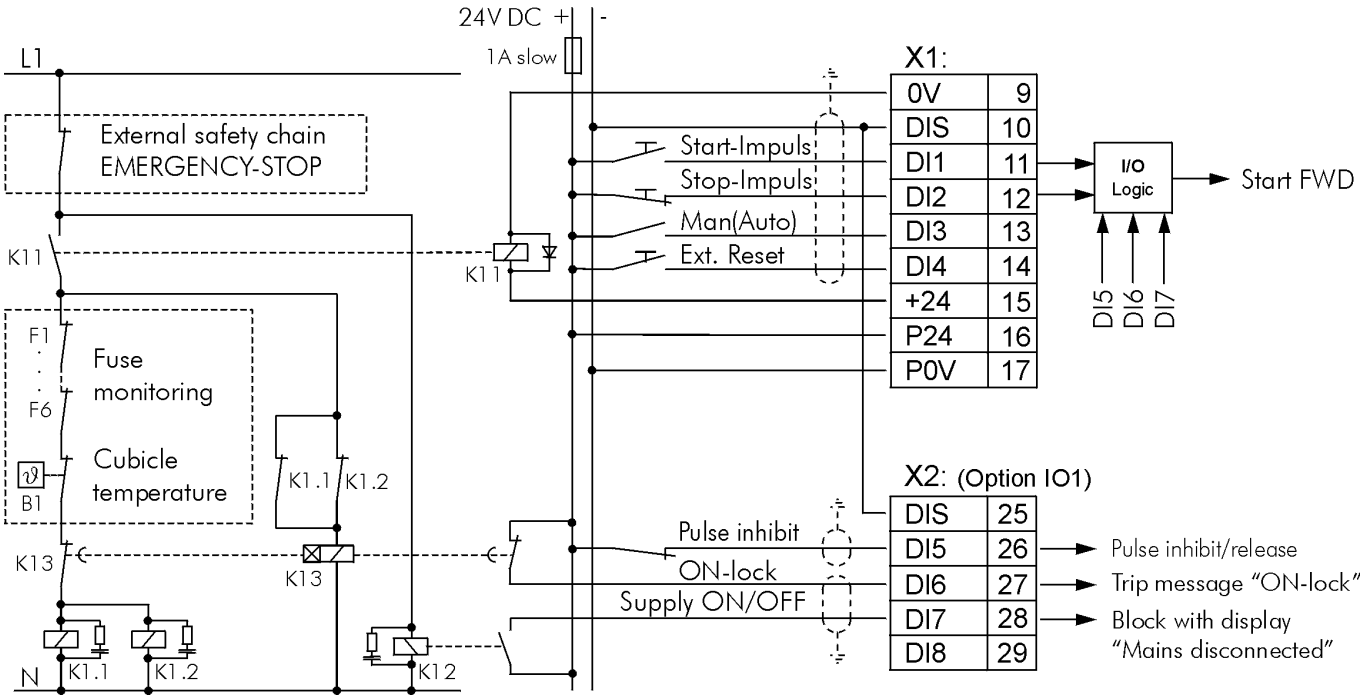


1.) Jumper, if no pulse inhibit/release signal is required.

Parameter	Name	Setting	Notes
C1.03	Braking mode	Motor brake A	Depending on the motor use A, B or C.
C2.00	Acceleration ramp 1	0.0...10.0...3200.0 s	Without function!
C2.01	Deceleration ramp 1	0.0...0.1...3200.0 s	Deceleration is adjusted according to the existing mass and the braking effect.
C2.02	Acceleration ramp 2	0.0...10.0...3200.0 s	Acceleration takes place at the current limitation if the working load is too big.
C2.03	Deceleration ramp 2	0.0...10.0...3200.0 s	Avoid motor overload by selecting a value that guarantees that the motor brake does not work during normal operation.
D2.00	DI1 selection	not used	Is only required by the logic module.
D2.04	DI6_2 selection	2. ramp	Is additionally required by the logic module.
F4.44	L5 signal to D1	DI1	Required from digital input DI1.
F4.45	L5 signal to D2	DI6_2	Required from digital input DI6_2.
F4.46	L5 logic function	AND	The drive only starts if the contacts for "Start FWD" and "Fast-stop" are closed.
F4.49	L5 selection	Start FWD	Internal wiring.

Contactor control with integration of monitoring units in the cubicle (ON lock):

If you use contactor control, the mains voltage will only be switched on as long as a Start command is active. Thus, the "standby losses" of the inverter are minimized and the lifetime of the fans is increased (see also parameter C6.00!). The control electronics are supplied permanently with a 24 V buffer voltage (>*pDRIVE*< *MX top*: 1 AC 230 V auxiliary voltage).
Different parts of the mains supply (e.g. mains fuses, contactor, charging connection, fan, cubicle temperature, etc.) have to be monitored, if the >*pDRIVE*< *MX top* inverter or devices with a 12-pulse rectification are used.



24V DC Auxiliary voltage for supplying the control electronics during "Mains OFF"

K11 Auxiliary relay (max. 100mA, 24V) that is activated via the digital output +24, parametrization "Supply ON" for activation of the contactor(s).

K12 Auxiliary relay (230V AC) for confirmation from the external safety chain (Emergency OFF). A renewed start pulse is necessary for restart. The inverter cannot be started while the safety chain is open.

K13 Time relay (time delay 0.5s; 230V AC) for confirmation from the safety chain (mains fuse blown, cubicle temperature >, contactor defect, ...). The lock is cancelled by using K11, the error message is stored by the inverter and a sum error message is displayed.

K1.1 Contactor for connection to mains supply. It opens after each deceleration, in the case of pulse inhibit, trip and "Supply OFF".

K1.2 Both contactors have to work in parallel mode if MX size 5 and 8, or 12-pulse supply are used.

For *MX plus* sizes A and B, the restart must be delayed for 20 s after every mains switch-off! Otherwise a trip message "Undervoltage 2" may be triggered.

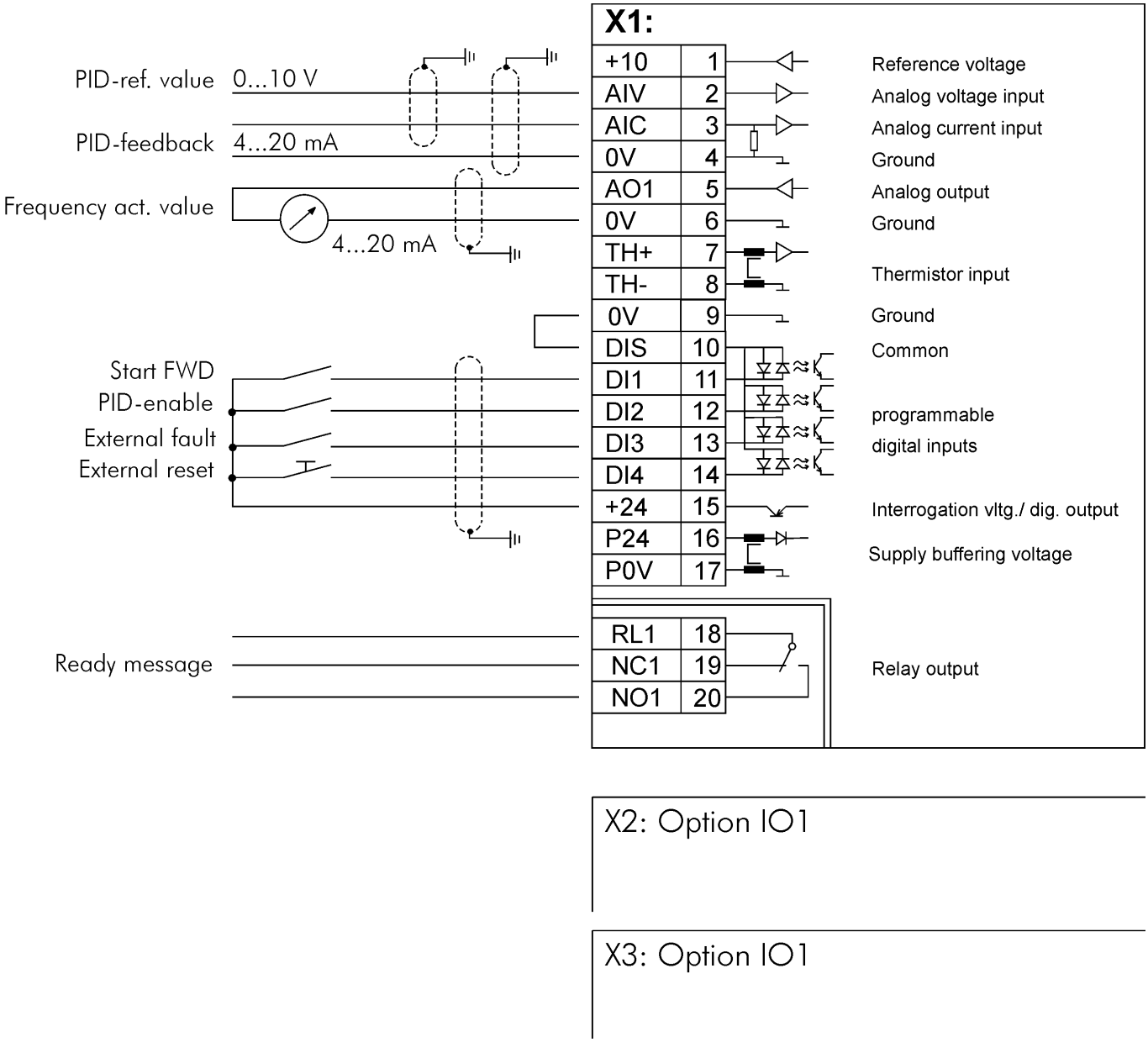
Parameter	Name	Setting	Notes
C6.00	Contactor control	active	
D2.00	DI1 selection	Start FWD impulse	parametrized for caliper control
D2.01	DI2 selection	Stop Impulse	
D2.02	DI3 selection	Manual (Auto)	
D2.03	DI4 selection	External Reset	
D2.04	DI6_2 selection	ON lock	confirmation from the fuse monitor, etc.
D2.05	DI7_2 selection	Supply ON/OFF	confirmation from the external safety chain
D4.00	+24 digital output	Line ON	output to contactor control

Macro M3 - drives with n^2 load moment and process control

Pressure, level and volume control, etc.

You can change to the higher rated motor power "P" by adjusting the respective motor data in parameters B3.00 to B3.01.
The energy saving function "Economy mode" is activated at step 1. The process reference value is defined via a voltage signal 0-10 V on AIV, the actual value is reported as a 4-20 mA signal on AIC. The devices are controlled with Start FWD, reverse rotation is blocked. In addition, the terminal strip functions "external fault" and "external reset" are programmed.
If further device-specific adjustments are necessary, please use the parameter description and adjust the parameters via the matrix area. The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M3

Parameter	Name	Setting	Notes
B2.03	Macro selection	Pump + PID	
C1.16	Economy mode	Step 1	Energy saving mode, step 1
C3.00	Minimum frequency	0.00...***5.00***...300.00 Hz	Setting of the lower frequency limit
C3.01	Maximum frequency	25.00...***50.00***...300.00 Hz	Setting of the upper frequency limit
C4.04	PID-controller enable	Yes process	Activates the PID controller
C4.05	Prop. gain (kp)	0.0...***20.0***...3200.0 %	Controller setting: amplification
C4.06	Integr. time (Tn)	0.00...***10.00***...320.00 s	Controller setting: integration time
C4.08	Ref. accel. ramp	0.0...***10.0***...3200.0 s	Setting in s / 100%
C4.09	Ref. decel. ramp	0.0...***10.0***...3200.0 s	Setting in s / 100%
C4.10	Output scaling -	-300.00...***+10.00***...+300.00 Hz	Minimal limit of controller output
C4.11	Output scaling +	-300.00...***+50.00***...+300.00 Hz	Maximum limit of controller output
D1.00	AIV selection	PID-reference value	Reference value as voltage signal 0-10 V
D1.01	AIV value 0 %	-200.00...***0.00***...+200.00 %	Used for reference value adjustment
D1.02	AIV value 100 %	-200.00...***100.00***...+200.00 %	
D1.04	AIC selection	PID feedback	Actual value > current signal 4-20 mA
D1.06	AIC value 0 %	-200.00...***0.00***...+200.00 %	Used for actual value adjustment
D1.07	AIC value 100 %	-200.00...***100.00***...+200.00 %	
D2.00	DI1 selection	Start FWD	Start/Stop (only forward - steady contact)
D2.01	DI2 selection	PID-enable	PID enable signal
D2.02	DI3 selection	External fault	Integration of an external fault
D2.03	DI4 selection	External reset	Integration of an external reset
D3.00	AO1 selection	|Output frequency|	Analog output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D4.01	Relay output 1	Ready + Run	Ready message at digital output RL1
E1.00	Current max. value	125 %	I_{MAX} - limitation with reference to $I_{N"C"}$
E2.00	Thermistor input Act.	not active	
E2.05	I_{MAX} at f_{NOM}	30...***100***...150 %	Definition of the motor protection. Currents in % with ref. to $I_{NOM,MOTOR}$
E2.07	Motor-time constant	1...***5***...3200 min	>5 min: 24 V buffer necessary!
E3.11	External fault Activat.	N.O. Ready + Run	Ext. fault is integrated by means of a make contact and monitored in ready + run mode

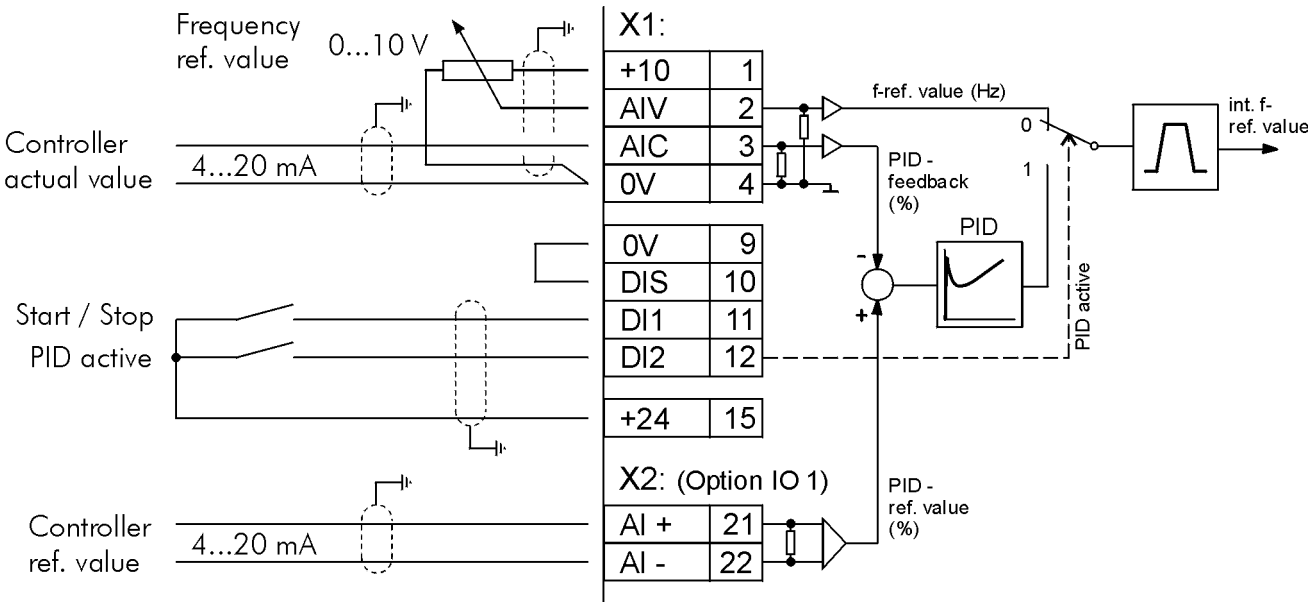
All motor data B3.00 to B3.04 are displayed in the short menu!

For the >*pDRIVE*< *MX plus*, the short menu also lists parameter B3.05 "Line voltage".

Supplement to Macro M3

Switch-over PID control mode / frequency default

The digital input "PID-enable" explained in macro M3 merely freezes the controller output at the last value or releases it.
The digital input function "PID active", however, allows you to switch from controller mode to direct frequency (speed) control and vice versa. In the following example, the direct frequency control is provided by a local potentiometer and the controller reference default with a 4...20mA signal (this requires the option card IO1).



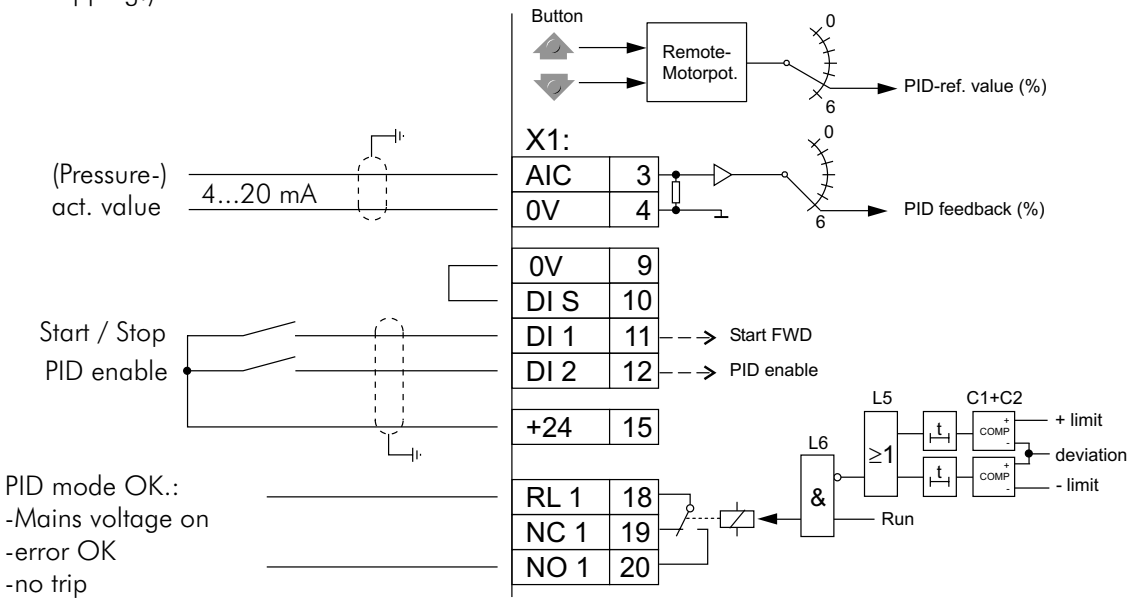
Parameter settings based on macro M3:

Parameter	Name	Setting	Notes
A6.00	Selection of zone 1	PID error	Adjustment of the display for PID-controller mode with switch-over to frequency control
A6.01	Selection of zone 2	PID-reference value	
A6.02	Selection of zone 3	Motor speed	
C4.04	PID enable	DI process	Switch-over according to digital input
D1.00	AIV selection	freq. ref Auto	Voltage ref. value for frequency control with minimum and maximum limit
D1.01	AIV value 0 %	-300.00...***e.g.10.00***...+300.00 Hz	
D1.02	AIV value 100 %	-300.00...***e.g.50.00***...+300 .00Hz	
D1.09	AI_2 selection	PID-reference value	Controller ref. value as 4...20mA signal
D1.10	AI_2 signal type	4...20mA	
D1.11	AI_2 value 0 %	-200.00...***0.00***...+200.00 %	
D1.12	AI_2 value 100 %	-200.00...***100.00***...+200.00 %	
D2.01	DI2 selection	PID active	Making contact switches over to controller mode

Through permanent feedback from the PID controller output, a smooth switch back to controller mode is possible.

PID process controller with reference value default on the keypad

The inverter works in controller mode without an external caliper and potentiometer, by setting the required reference value directly on the inverter keypad. Only the actual value signal (e.g. actual pressure value 4...20 mA) is connected to terminals 3 and 4 on the terminal strip.
Due to jumpers between terminals 9 and 10, as well as 11 and 15, controller mode starts as soon as the mains voltage is switched on (→ for parametrization of locked (VICB) parameters, switch to local mode and press the Stop key or open strapping!)



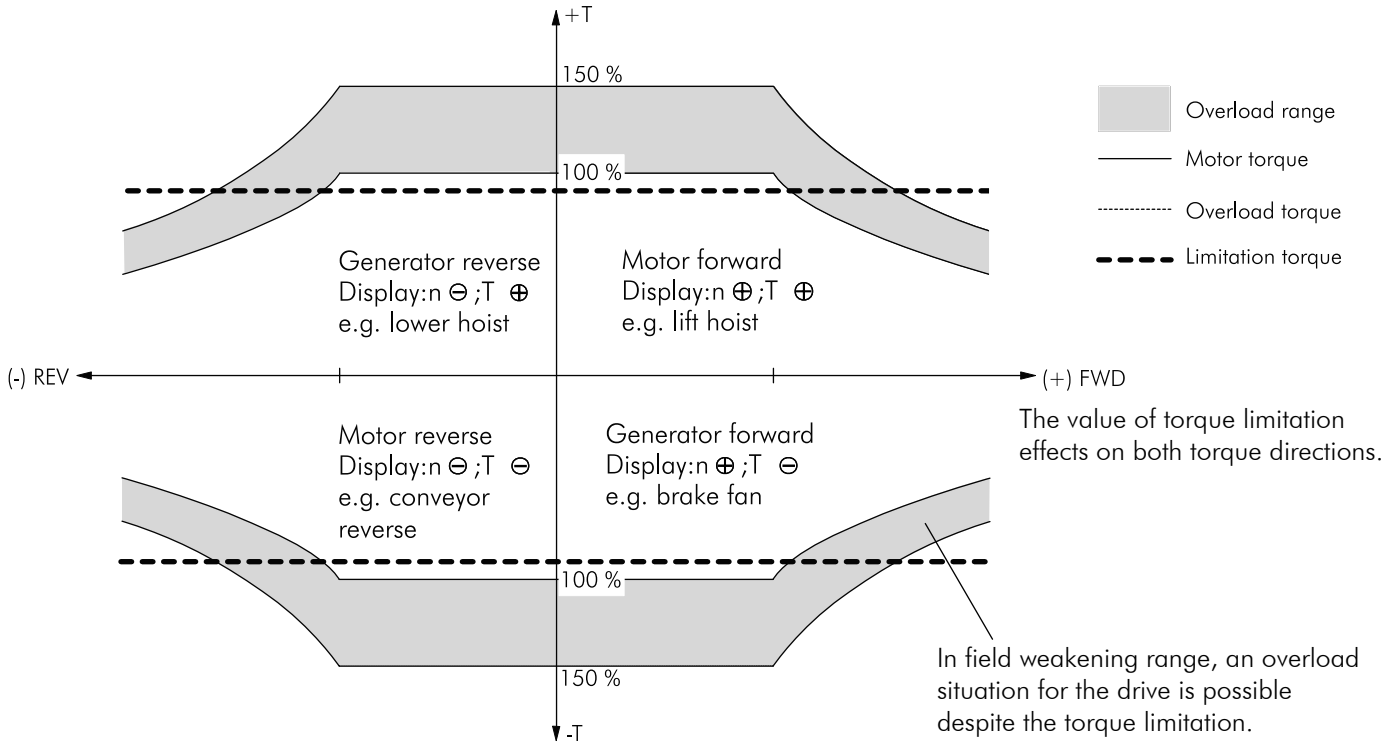
Parameter settings based on macro M3:

Parameter	Name	Setting	Notes
A6.00	Select. zone 1	PID error W-X	Adjustment of the display for PID control mode
A6.01	Select. zone 2	PID-ref. value W	
A6.02	Select. zone 3	PID-feedback X	
D1.00	AIV selection	not used	After resetting to factory default, the parameters do not longer appear in the short menu
D1.01	AIV value 0%	-300.00...***0.01***...+300.00 Hz	
D1.02	AIV value 100%	-300.00...***50.01***...+300.00 Hz	
D4.01	Relay output 1	Output logic L6	Message "PID mode OK"
D6.06	Rem. MP selection	PID-reference value	Remote motorpot. for PID-ref. value default
D6.07	Rem. MP min. value	-200.00...***0.00***...+200.00 %	Lower limit for PID-ref. value
D6.08	Rem. MP max. value	-200.00...***100.00***...+200.00 %	Upper limit for PID-ref. value
D6.11	Rem./MP control	Keypad	Keys on keypad for PID-ref. value
D6.12	Rem. ref. storage	at Mains-off	Last ref. value is reactivated after Supply ON
F4.00	C1 Signal to E1	PID error	Monitoring of positive PID deviation
F4.02	C1 reference	-200.0...***e.g.+50.0***...+200.0 %	With time delay to span from start time until +error is OK.
F4.03	C1 function	E1 > E2	
F4.04	C1 Hysteresis/Band	0.0...***2.0***...100.0 %	
F4.06	C1 Time set	0.0...***e.g.30.0***...3200.0 s	
F4.08	C2 Signal to E1	PID error	Monitoring of negative PID deviation with delayed feedback if not OK.
F4.10	C2 reference	-200...***e.g.-5.0***...+200%	
F4.11	C2 function	E1 < E2	
F4.12	C2 Hysteresis/Band	0.0...***2.0***...100.0 %	
F4.14	C2 time set	0.0...***e.g.10.0***...3200.0 s	
F4.44	L5 signal to D1	Output comp. C1	Link between the two monitoring modules for error
F4.45	L5 signal to D2	Output comp. C2	
F4.46	L5 logic function	OR	
F4.50	L6 signal to D1	Ready + Run	Link with Ready and Run feedback
F4.51	L6 signal to D2	Output logic L5	
F4.52	L6 logic function	AND- neg. (D2)	

Macro M4 - drives with torque limitation

Test benches,
winches, coilers,
etc.

The torque limitation signal and the frequency ref. value are defined as current signal via the analog current inputs AI_2 (0-20 mA) and AIC (4-20 mA).
The respective active quadrant results from the choice of direction.

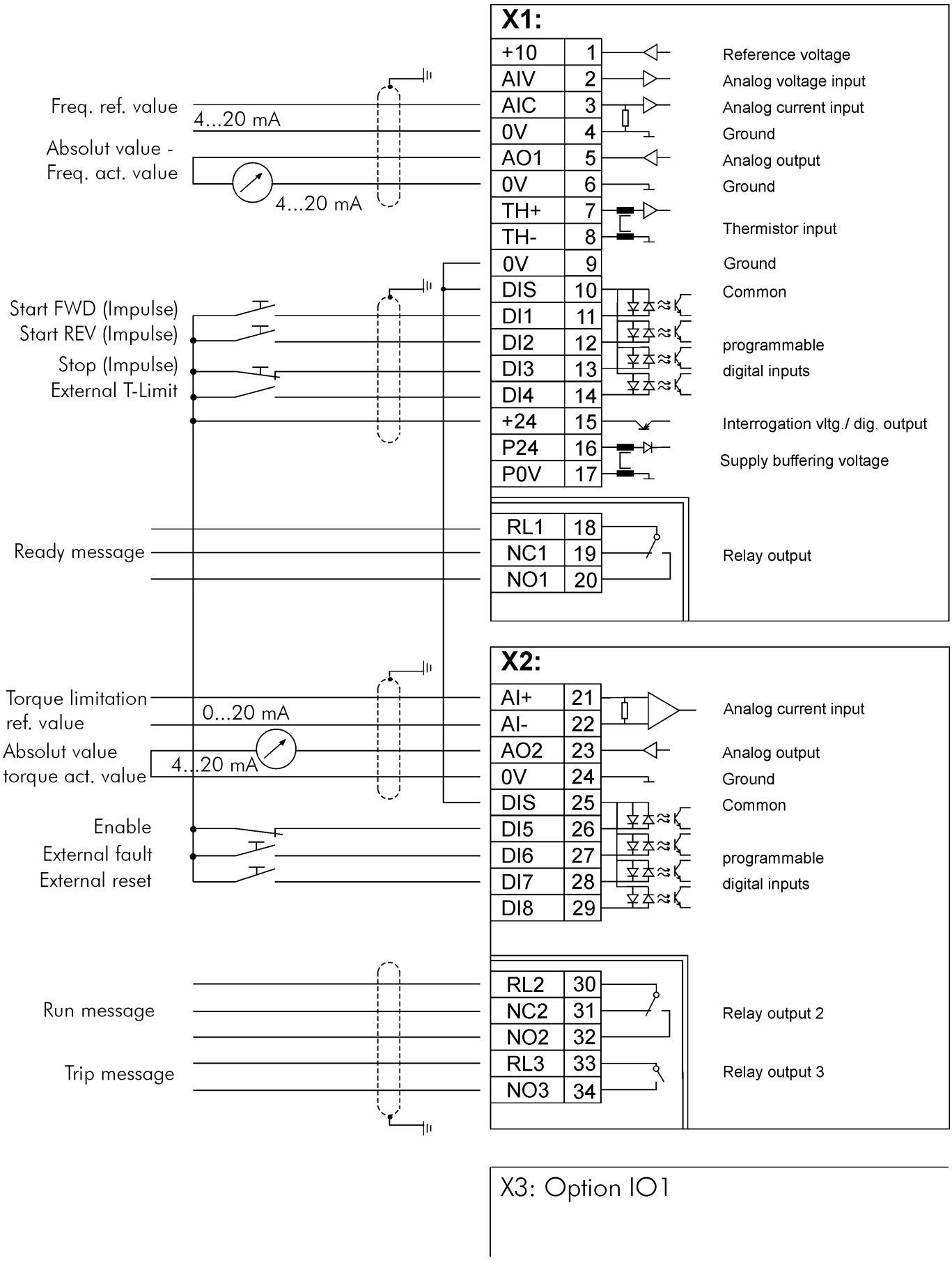


When the set torque limit is reached, the inverter reacts by reducing the speed in motor mode and increasing the speed in generator mode.

The units are controlled via the impulse signals Start FWD, Start REV and Stop.
In order to activate the torque limitation function, the switch Ext. T-Limit must be closed. Terminal DI5 must be set to pulse enable on the hardware side.
In addition, the terminal functions "external fault" and "external reset" are programmed.

If further device-specific adjustments are necessary, please use the parameter description and adjust the parameters via the matrix area. The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M4

Parameter	Name	Setting	Notes
B2.03	Macro selection	Test bench	or: coiler
C1.00	Increase start torque	0...***1***...30 %	
C2.00	Acceleration ramp 1	0.0...***3.0***...3200.0 s	Setting in s/nom. motor frequency
C2.01	Deceleration ramp 1	0.0...***3.0***...3200.0 s	Setting in s/nom. motor frequency
C3.01	Maximum frequency	25.00...***50.00***...300.00 Hz	Setting of the upper frequency limit
C3.02	Direction enable	Enable FWD/REV	Forward and reverse released
D1.04	AIC selection	freq. ref Auto	Frequency ref. value at input AIC (mA)
D1.06	AIC value 0%	-300.00...***0.00***...300.00 Hz	Defines the frequency range for the 4-20 mA signal.
D1.07	AIC value 100 %	-300.00...***50.00***...300.00 Hz	
D1.09	AI_2 destination	Torque limit	Torque limitation ref. value as current signal (0-20 mA) in% of T_N
D1.11	AI_2 value 0%	-200.00...***0.00***...200.00 %	Adjustment of the torque limitation reference value
D1.12	AI_2 value 100 %	-200.00...***100.00***...200.00 %	
D2.00	DI1 selection	Start FWD impulse	Start FWD via impulse contact
D2.01	DI2 selection	Start REV impulse	Start REV via impulse contact
D2.02	DI3 selection	Stop Impulse	Stop via impulse contact (break contact)
D2.03	DI4 selection	External T limitation	Activates torque limitation
D2.04	DI6_2 selection	External fault	Integration of an external fault
D2.05	DI7_2 selection	External reset	Integration of an external reset
D3.00	AO1 selection	|Output frequency|	Analog output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D3.04	AO2_2 selection	|Torque|	Analog output 2 - motor torque actual value (4-20 mA = 0...1.5 x T_N)
D3.07	AO2_2 max.value	-200...***150***...200 %	20 mA corr. to 150% nom. motor torque
D4.01	Relay output 1	Ready	Ready message at digital output RL1
D4.02	Relay output 2_2	Run	Run message at digital output RL2_2
D4.03	Relay output 3_2	Trip	Trip message at digital output RL3_2
E2.00	Thermistor input Act.	not active	
E2.04	I_{MAX} at 0 Hz	0...***50***...150 %	Definition of the motor protection Currents in % with ref. to $I_{NOM,MOTOR}$
E2.05	I_{MAX} at f_{NOM}	30...***100***...150 %	
E2.07	Motor-time constant	1...***5***...3200 min	>5 min: 24 V buffer necessary!
E3.11	External fault Activat.	N.O. Ready + Run	Ext. fault is integrated by means of a make contact and monitored in ready + run mode

All motor data (matrix area B3) are displayed in the short menu !!

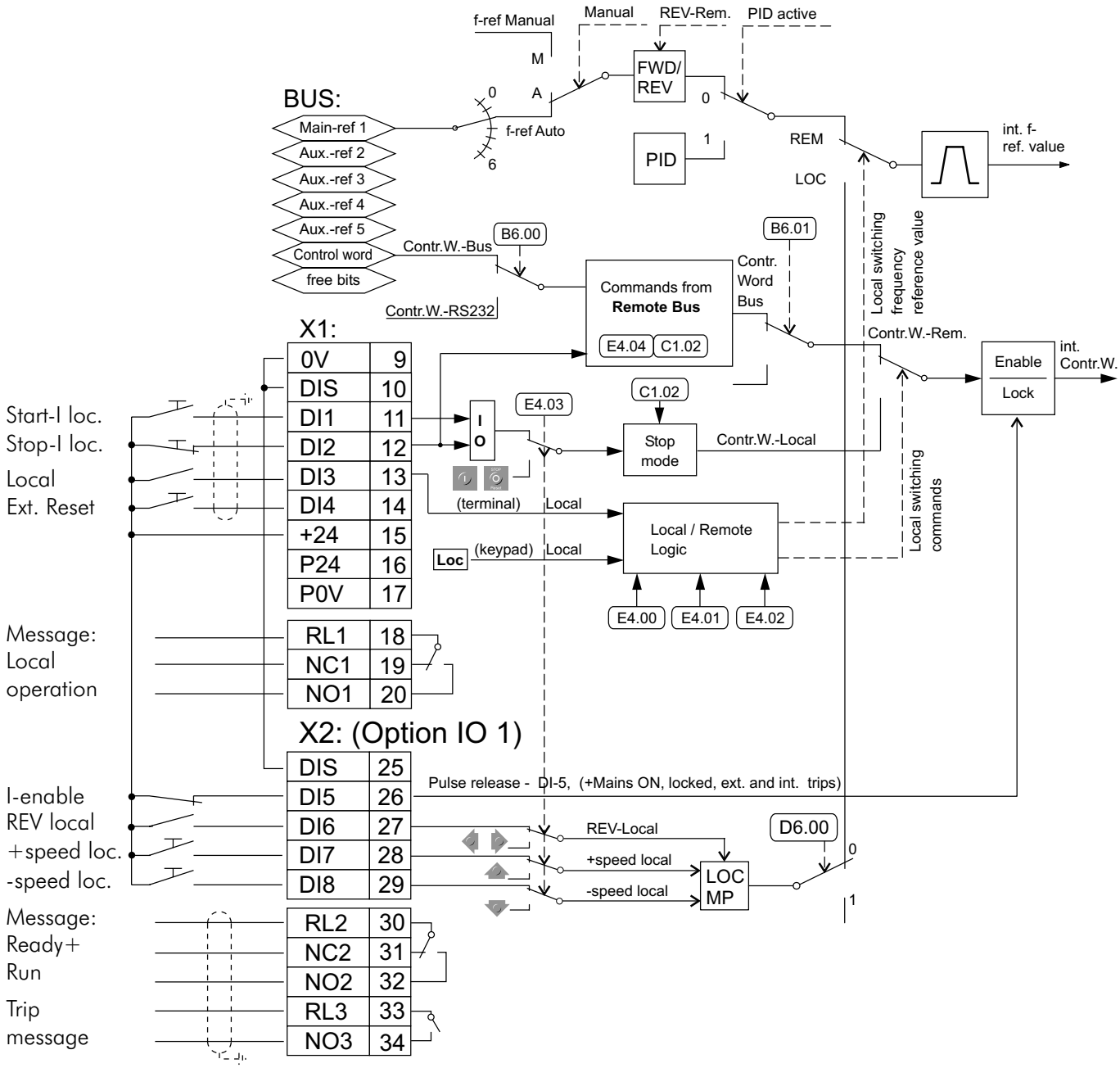
In addition, we recommend that you set parameter C1.02 (Stop mode) to "free wheel" !

For the >*pDRIVE*< *MX plus*, the short menu also lists parameter B3.05 "Line voltage".

Supplements to macros M1 to M4

Switching over to "local control" with local keys

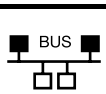
The figures "Configuration of Analog Inputs" in Chapter D1 and "Overview of Control Commands" in Chapter D2 show the various possibilities for switching between the operating modes.
The switch-over from remote mode (bus control or terminal control) to local mode (on the keypad or locally via digital inputs) is absolutely smooth.
The switching example describes the switch-over between Profibus control and local control of the motor. Thereby, both the reference value default and the digital control commands are switched over. In local mode, the keys of the keypad are replaced by local keys that are integrated via the terminal strip.



Parameter settings based on macro M1:

Parameter	Name	Setting	Notes
B6.00	Select bus	PROFIBUS DP	Parametrization of Profibus DP and definition of the address
B6.01	Select remote	Bus	
B6.02	Slave address	0...***Address***...126	
B6.03	Stop mode Time out	Trip	Behavior at trip of bus with adjustable delay time.
B6.04	Time OUT	0.0...***e.g. 10.0***...3200.0 s	
B6.06	Main reference 1	freq. ref Auto	Frequency ref. default in remote mode
D1.04	AIC selection	not used	
D2.00	DI1 selection	Start impulse local	Key command Start (make contact)
D2.01	DI2 selection	Stop impulse local	Key command Stop (break contact)
D2.02	DI3 selection	Local (Rem)	Making contact = local mode
D2.03	DI4 selection	Ext. Reset	Key command trip confirmation
D2.04	DI6_2 selection	REV local	Making contact = reverse
D2.05	DI7_2 selection	+speed local	Key command faster (break contact)
D2.06	DI8_2 selection	-speed local	Key command slower (break contact)
D4.01	Relay output 1	Local operation	Relay closed in local mode
D4.02	Relay output 2_2	Ready + Run	Relay closed for Ready + Run
D4.03	Relay output 3_2	Trip	Relay closed for trip
E4.02	Loc/Rem-switch	Terminals	Switch-over to local mode via terminal strip
E4.03	Ctrl. mode local	Terminals	Keys on keypad replaced by digital inputs

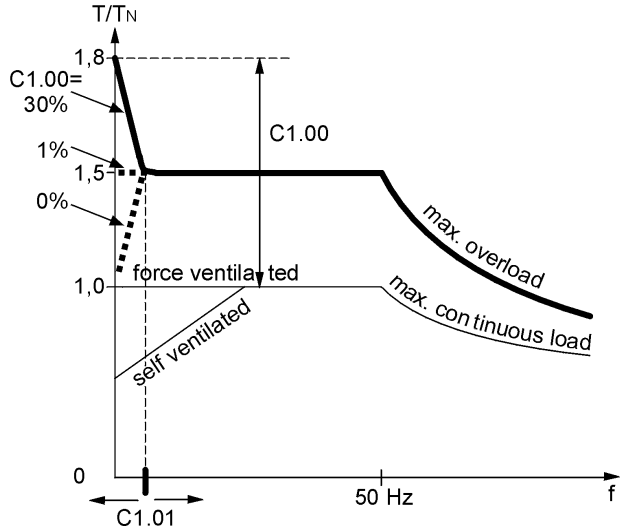
Bit 10, "Control OK" of the bus control word must be set in order to be able to switch back to remote (bus) mode !

B6		**Communication menu**

All parameters concerning connection of the fieldbus to the frequency inverter can be found in the manuals "Option Profibus PB01", "Option Interbus GW-IBO1", "Option CANopen GW-CBO1" and "Option DeviceNet GW-DBO1" !

C1 General functions

C1.00	Increase start torque	VCB	0...***1***...30 % (see Macro)
C1.01	Increase steady torque	VCB	5...***10***...45 Hz



For applications requiring a high start torque, the start torque (100% or 150% T_N) can be increased to 180% T_N.

For pumps and fans, the setting 0% (T_A = approx. 100% T_N) is usually sufficient.

e.g. C1.00 = 0% corr. to approx. 100% $T_{N"C"}$
C1.00 = 1% corr. to approx. 150% $T_{N"C"}$
C1.00 = 30% corr. to approx. 180% $T_{N"C"}$

The range, in which this increase is effective, can be set using parameter C1.01.
The setting of the parameter has no effects on the function and the result of autotuning.

C1.02	Stop mode	VCB	deceleration ramp

0 .... Free wheel (OFF 2) — A Stop command is followed by immediate pulse inhibit. The motor runs out freely.
With this setting, "Disabled" is displayed instead of "Stop".

1 .... Decel. ramp (OFF 1) • — A stop command is followed by slowing down of the motor (if possible) according to the set deceleration ramp. On reaching 0 Hz, a pulse inhibit is issued.

2 .... Fast-stop (OFF 3) — A Stop command is followed by braking of the motor within the shortest possible time. On reaching 0 Hz, a pulse inhibit is issued (useful in combination with an external braking unit, an IR (Intelligent Rectifier) or activated motor brake with parameter C1.03).

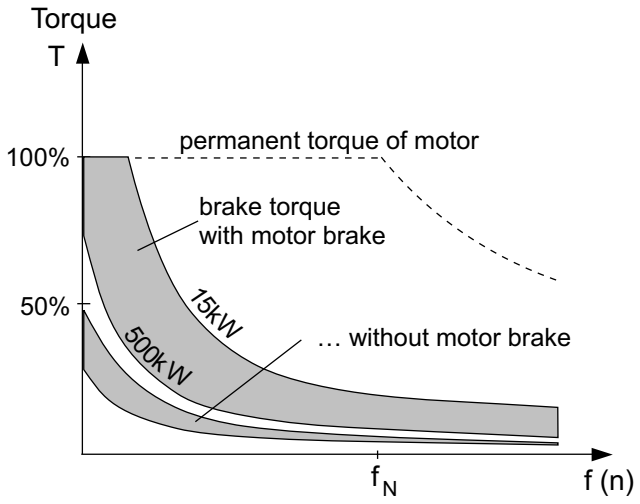
Stop command means the Off command from remote or local mode.

C1.03	Braking mode	VICB	no braking function

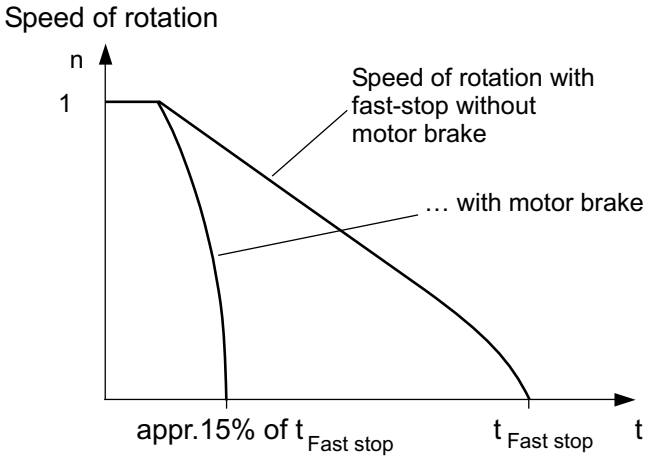
0 .... No braking function •	no brake, DC voltage limitation extends the deceleration ramp as required
1 .... Ext. Braking unit	ext. braking unit connected, the DC voltage limitation levels are raised above the braking unit levels
2 .... Motor brake A *3 .... Motor brake B* *4 .... Motor brake C*	motor brake active, the braking energy is transformed into heat in the motor, motor cable and inverter. Depending on the unit size and motor type, the best braking effect is obtained with setting A, B or C.
5 .... FI control 1 BU	1.) activates the internal braking unit (only available for *>pDRIVE< MX plus* Size A and B) or 2.) activates the control of the braking unit *BU plus*.
6 .... FI control 2 BU	has to be used in case of two connected braking units (only possible for *>pDRIVE< MX plus* Size 3...5)

At *MX top* position 5 and 6 do not exist.

Setting 2...4: Motor brake



Available brake torque with motor brake

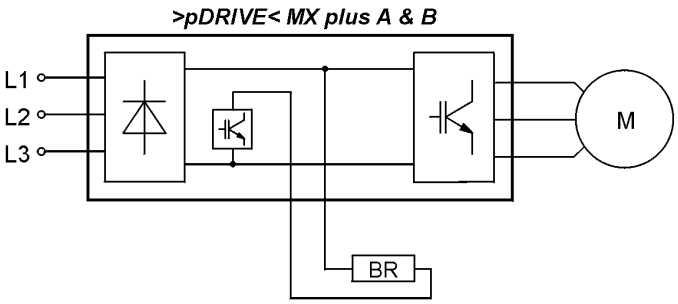


Time to stop of a drive with motor brake

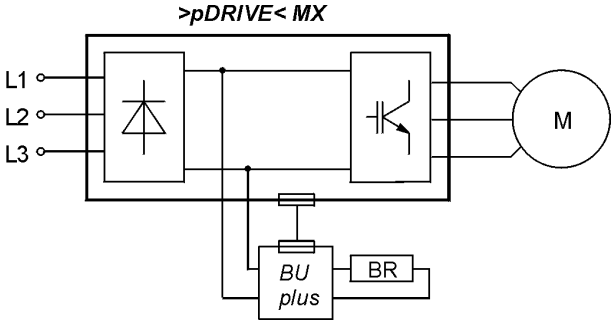
The "motor brake" is an extremely economic alternative to the external braking unit with resistor. The fast-stop of a 250 kW drive with 2..3-fold motor mass, for example, is possible within less than 4 seconds.
The motor noise is louder while the motor brake is working.
Most of the braking energy is transformed into heat in the motor.

Setting 5: FI control 1 BU

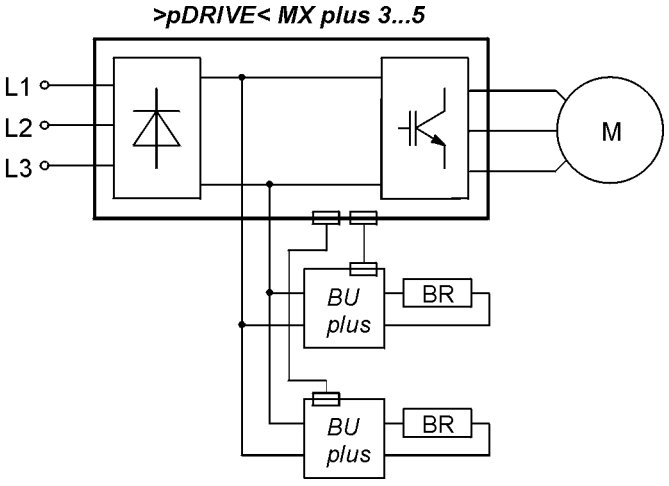
internal braking unit (MX size A and B)



braking unit *>pDRIVE< BU plus*



Setting 6: FI control 2 BU



Both braking units are controlled and monitored by the inverter.
In case of reduced operation with only one braking unit BU, the control and power connections must be disconnected.
Additionally, the parameter setting has to be changed to "FI control 1 BU".

C1.04	Braking level	VCB	660...***790***...820 V

The parameter defines the trigger voltage for the braking unit *>pDRIVE< BU plus*. Depending on the setting of parameter B3.05 "Line voltage", the minimum value differs.

The right setting of the braking level depends on the mains voltage:

– for 3AC 400V mains voltage - 660 V (680 V at operation with IR – Intelligent Rectifier)
– for 3AC 440V mains voltage - 720 V (750 V at operation with IR – Intelligent Rectifier)
– for 3AC 460V mains voltage - 750 V (820 V at operation with IR – Intelligent Rectifier)
– for 3AC 500V mains voltage - 790 V (820 V at operation with IR – Intelligent Rectifier)

To increase the braking power the adjustment up to 820 V is allowed.

At MX size A and B with internal braking unit the braking level is adjustable between 780…790 V. At operation with Intelligent Rectifier *LX plus* the internal braking unit is not available.

C1.05	BU parallel operation	VCB	not active

0 ... not active •
1 ... active

Position 1 activates a special function for parallel running of several *MX plus* and braking units *BU plus* with common DC link. Therefore, all drives must have set the same braking level C1.04.
The function provides uniformly distributed braking power.

C1.06	Pre-set reference selection	VICB	not used

0 .... not used • Hz
1 .... f-ref Manual Hz
2 .... f-ref Auto Hz
3 .... f-correction Hz
4 .... T-limitation %
5 .... PID reference %

Individual settings that cannot be selected, have already been assigned by one of the other reference value sources D1.00, D1.04, D1.09, D1.14, D6.06 or by a bus reference value!

The pre-set reference values can be used as a source for various ref. value defaults.

See figure "Configuration of Analog Inputs" in section D1 - Analog Inputs.

C1.07	Pre-set reference 1	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.08	Pre-set reference 2	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.09	Pre-set reference 3	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.10	Pre-set reference 4	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.11	Pre-set reference 5	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.12	Pre-set reference 6	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.13	Pre-set reference 7	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.14	Pre-set reference 8	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %

The pre-set ref. values are selected using the digital commands Pre-set A, B and C, which must be programmed for 0...3 digital inputs depending on the required number of pre-set ref. values. See D2 – Digital Inputs.

DIx parametrized at Pre-set A	DIx parametrized at Pre-set B	DIx parametrized at Pre-set C	Selected value
0	0	0	Pre-set reference 1
1	0	0	Pre-set reference 2
0	1	0	Pre-set reference 3
1	1	0	Pre-set reference 4
0	0	1	Pre-set reference 5
1	0	1	Pre-set reference 6
0	1	1	Pre-set reference 7
1	1	1	Pre-set reference 8

→ A digital input does not need to be programmed for this reference value !!

The pre-set ref. values are pure reference values and do not include any Start commands!

C1.15	Jog frequency	VCB	-10.00...***0.00***...10.00 Hz

The jog function is used for inspection, setting or adjustment purposes. For this purpose, the digital command "Jog" (see D2 – Digital Inputs) is available. If this function is activated, the output frequency will accelerate to the jog frequency without acceleration/deceleration times. An additional ON/OFF command is not required. Jog mode is only possible when the unit is stopped!

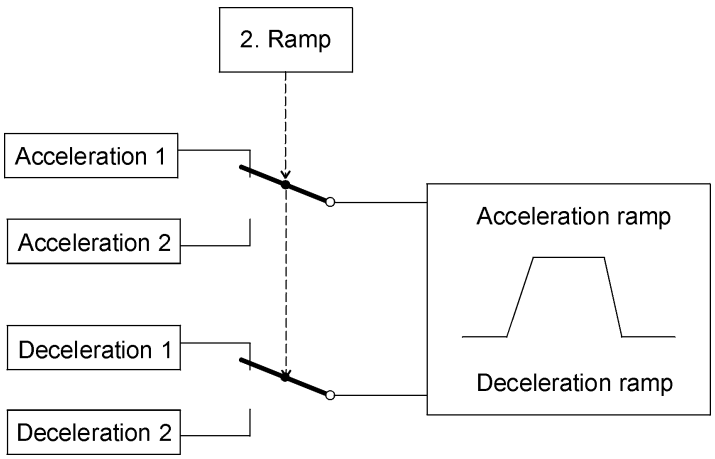
C1.16	Economy mode	VCB	not active (see Macro)

0 ... not active •
1 ... Step 1 (= slight reduction)
2 ... Step 2 (= medium reduction)
3 ... Step 3 (= strong reduction)
4 ... Step 4 (= very strong reduction)

In applications with a square load torque curve (e.g. centrifugal pumps or fans), the magnetization current in the motor can be reduced with decreasing speed. This leads to a lower power uptake, thus saving energy.

C2 Hz Ramps

C2.00	Acceleration ramp 1	VCB	0.0...***0.0***...3200.0 s (see Macro)
C2.01	Deceleration ramp 1	VCB	0.0...***0.0***...3200.0 s (see Macro)
C2.02	Acceleration ramp 2	VCB	0.0...***20.1***...3200.0 s
C2.03	Deceleration ramp 2	VCB	0.0...***20.1***...3200.0 s



There are 2 accel./decel. ramp sets available. The digital command "2.Ramp" (see D2 – Digital Inputs) switches between these sets. This switch-over is used primarily with Emergency OFF functions and accel./decel. times that depend on the speed.

The set accel./decel. time is with reference to the nominal motor frequency B3.03.

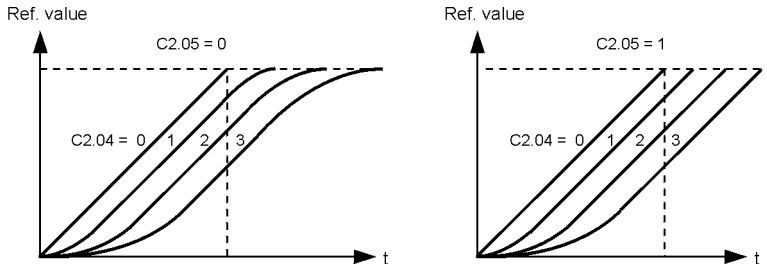
C2.04	S-ramp	VCB	no S-ramp

0 ... no S-ramp •
1 ... S-ramp step 1 (thereby, the ramp times are 10% [5%] longer)
2 ... S-ramp step 2 (thereby, the ramp times are 25% [12%] longer)
3 ... S-ramp step 3 (thereby, the ramp times are 50% [25%] longer)
(longer ramp time with C2.05 = 0 [C2.05 = 1])

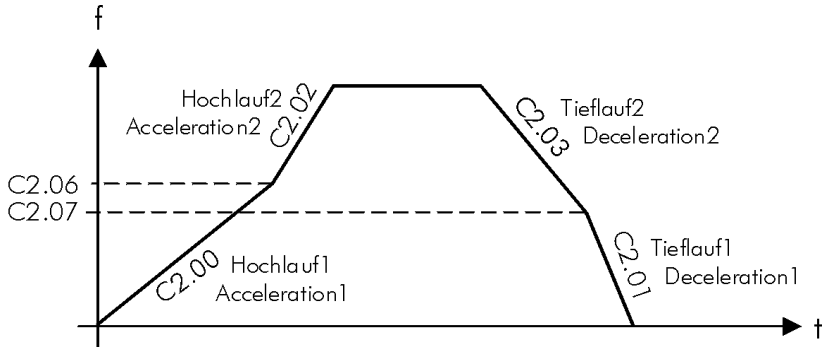
With this parameter, a gentle start and stop and/or gentle start-up of the reference frequency is possible. Typical applications are crane drives, conveyors, etc.

C2.05	S-ramp mode	VCB	Begin + End

0 ... Begin + End •
1 ... Begin only

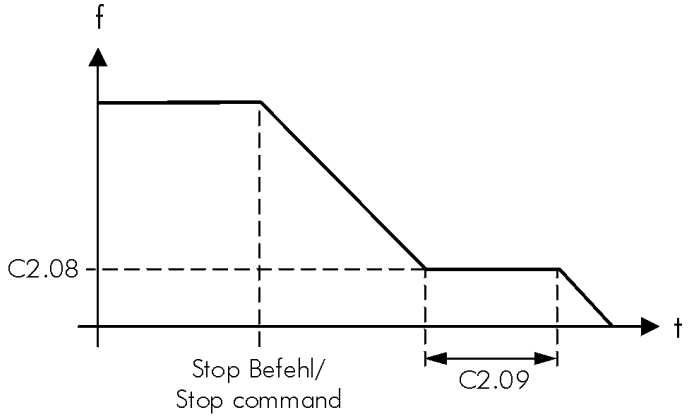


C2.06	Switch 1./2. Acceleration	VCB	0.00...***0.00***...300.00 Hz
C2.07	Switch 1./2. Deceleration	VCB	0.00...***0.00***...300.00 Hz



Parallel to the function of digital inputs D2 "19 2.ramp" this parameters can be used for independent switch-over of the acceleration and deceleration ramps. If the setting is zero, the respective function is not active.

C2.08	Decel. persistant frequency	VCB	0.00...***0.00***...C3.00 "Min. freq."
C2.09	Decel. persistant time	VCB	0.0...***0.0***...160.0 s

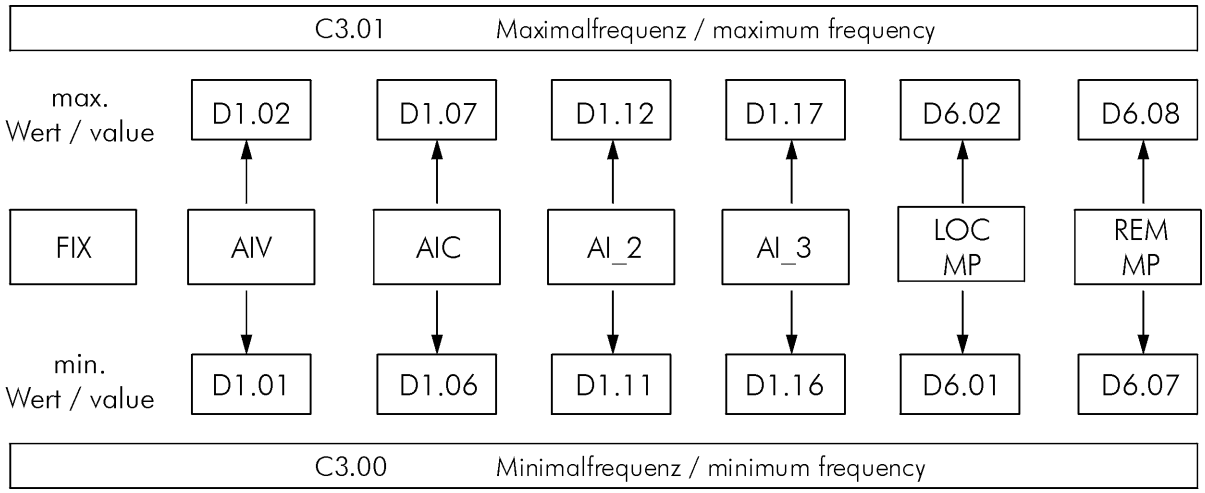


With these parameters a persistant time during Stop (deceleration) can be set. This function is typically used for controlled closing for a damper of a pump drive.

This function can only be adjusted below the set minimum frequency and is only active, if C3.02 "Direction enable" is set to "0 Disable REV" or "1 Disable FWD".

C3	Hz	Speed range

C3.00	Minimum frequency	VCB	0.00...***0.00***...300.00 Hz
C3.01	Maximum frequency	VCB	25.00...***50.00***...300.00 Hz



One minimum and one maximum value can be assigned individually to each ref. value source.
In addition, a min./max. limit, effective for all ref. value sources, can be set using parameters C3.00 and C3.01.

If both directions of rotation are enabled with parameter C3.02 (setting: "Enable FWD/REV"), the minimum limitation C3.00 is not effective.

If necessary, the respective minimum limitations of the reference value sources can be used.

C3.02	Direction enable	VICB	Disable REV (see Macro)

0 ... Disable REV • Reverse direction blocked in all operating modes.
1 ... Disable FWD Forward direction blocked in all operating modes.
2 ... Enable FWD/REV Both directions of rotation are possible.

After "Catch on the fly" a free-wheeling drive in reverse is slowed down at the current limit with setting "0". The same applies to forward rotation with setting "1".

C3.03	Phase rotation	VICB	U-V-W / A-B-C

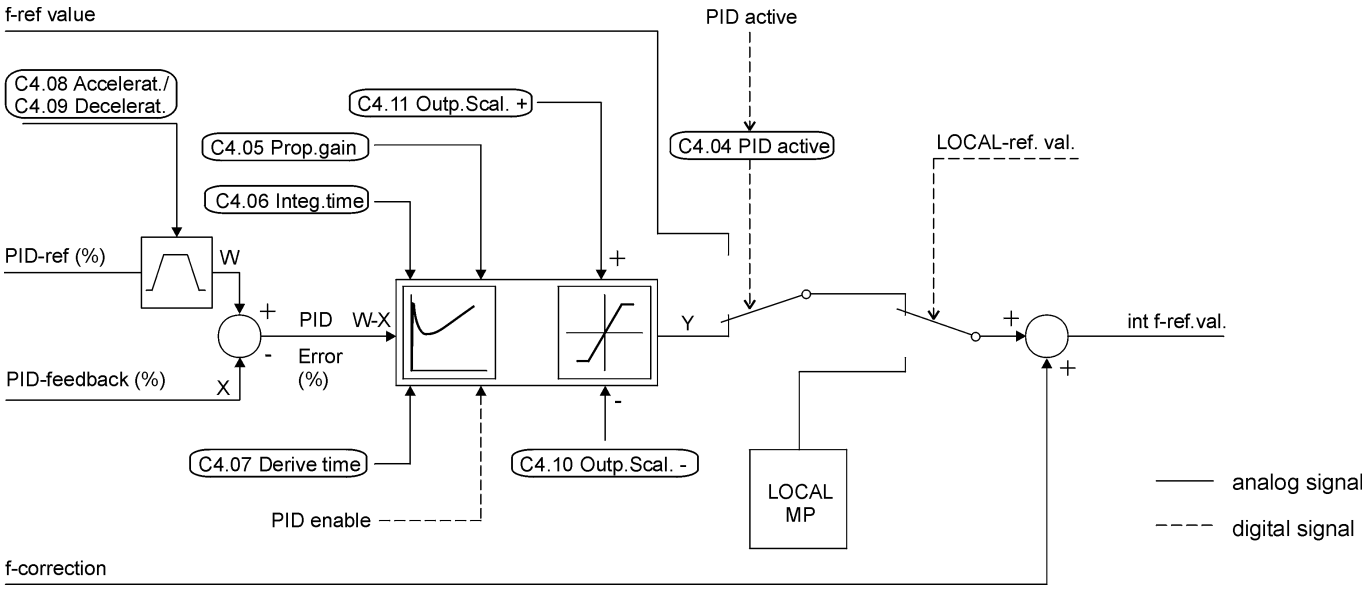
0 ... U-V-W / A-B-C • normal forward rotation
1 ... U-W-V / A-C-B inverted rotary field

This parameter inverts the rotary field, thus making reconnection of the motor cable unnecessary.

Remarks for field weakening operation:

>pDRIVE< MX frequency inverters calculate the sweep torque of the motor using the adjusted motor data (nom. speed B3.04, nom. power B3.00, ...) and the measured motor data (autotuning data B4). A too high load torque (in relation to the frequency) leads to current limitation and therefore to reduction of the output frequency.

PID Process controller



PID-reference value

The following values can be used as a reference value source:

– External motor potentiometer	Parameter D6.06
– Pre-set reference values	Parameter C1.06
– Analog input AIV: 0-10 V	Parameter D1.00
– Analog input AIC: 0(4)-20 mA	Parameter D1.04
– Analog input AI_2: 0(4)-20 mA	Parameter D1.09
– Analog input AI_3: 0(4)-20 mA	Parameter D1.14
– Bus reference value	Parameter B6.06 to B6.10

In order to optimize the behavior of the controller, it is recommended that the acceleration and deceleration ramps (parameter group C2) have short settings. A separate ramp time can be set for the reference value (PID-ref) using parameter C4.08, C4.09.

Actual value

Any analog inputs (AIV, AIC, AI_2, AI_3 and bus) can be used as actual value inputs. The two values PID-ref. and actual are standardized in % and must be scaled at the respective reference value source.

Displays

All controller-specific values such as reference value, actual value, error and PID controller output are also available as actual value displays in the basic display.

Error

The error corresponds to the difference between the PID-ref. value after the accel./decel. ramp and the actual value. The difference is created independent of the controller destination (C4.04) and the operating state. Therefore, it can also be processed by the logic blocks (F4).

Controller

The PID-controller is designed as a process controller with the controller output "Frequency [Hz]". Prop. gain (kp), Integration time (Tn) and Derive time (Tv) can be adjusted individually. In addition, an external controller enable can be configured via the terminal strip (see D2).

Output scaling

The controller output is limited by C4.10 and C4.11. The PID output is always standardized in Hz, and is applied as internal ref. frequency after the effective limitation.

PID-controller active

The PID-controller is activated using parameter C4.04 (position 1 or 2 and 24 V at the assigned digital input). The switch-over (from operating mode to control mode) is smooth, since the controller output is adjusted to the current reference value if "PID-controller not active". For W-X ≠ 0, however, the kp share is effective immediately after switch-over.

Enable/disable

If one of the digital inputs (field D2) is parametrized for the function "PID-enable", the controller is only enabled in run state. If the controller is locked, the output will remain at the last value.

Change of motor direction during controller mode

- With parameter C3.03, the rotary field can be inverted → parametrization does not need to be modified
- or by changing parameters (negative settings for limitations, negative settings for ref. and actual value standardization, "Start REV" set when switching over to operating mode).

Switch-over to LOCAL

When switching from remote controller mode to local (keypad or terminals), the controller output frequency [Hz] is defaulted directly by the local motor potentiometer on the keypad. The switch-over to the downstream motor potentiometer value or controller output and back is smooth.
→ see "Supplements to macro M3"

C4.00	Reference monitoring [%]	—	read only

Reference value before acceleration integrator.

C4.01	Feedback monitoring [%]	—	read only
C4.02	Error [%]	—	read only
C4.03	PID output [Hz]	—	read only

100% output corresponds to 163.84 Hz.

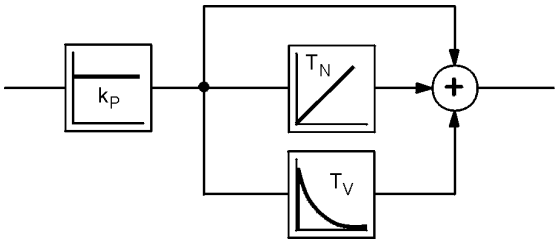
C4.04	PID active	VICB	no (see Macro)

0 ... no •	
1 ... yes Process *2 ... DI Process*	The PID is used to control an external process. (release via digital input → assignment of an input in field D2 necessary)
3 ... yes Speed *4 ... DI Speed*	The PID is used to control the speed. (release via digital input → assignment of an input in field D2 necessary)

C4.05	Prop. gain (kp)	VCB	0.0...***20.0***...3200.0 % (see Macro)
C4.06	Integration time (Tn)	VCB	0.00...***10.00***...320.00 s (see Macro)

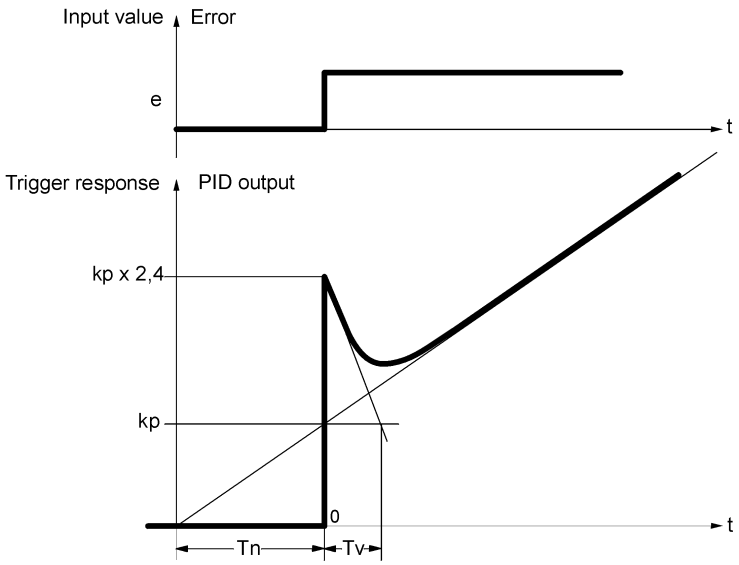
Setting T_n=0 deactivates the integration time of the controller.

C4.07	Derive time (Tv)	VCB	0.00...***0.00***...320.00 s

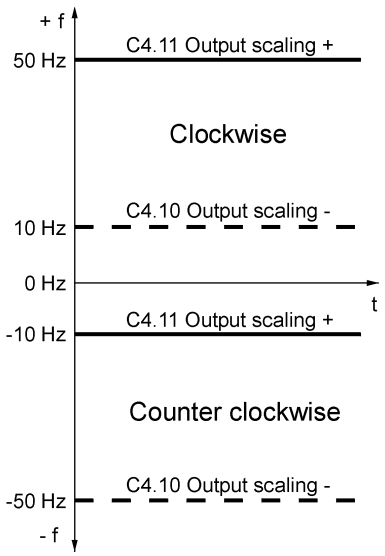


The effect of the integration time and derive time depends on k_p.

Control system behaviour:



Limitation of regulating value:



C4.08	Ref. acceleration ramp	VCB	0.0...***10.0***...3200.0 s (see Macro)
C4.09	Ref. deceleration ramp	VCB	0.0...***10.0***...3200.0 s (see Macro)
C4.10	Output scaling -	VCB	-300.00...+***10.00***...+300.00 Hz (s..M.)
C4.11	Output scaling +	VCB	-300.00...+***50.00***...+300.00Hz (s. M.)

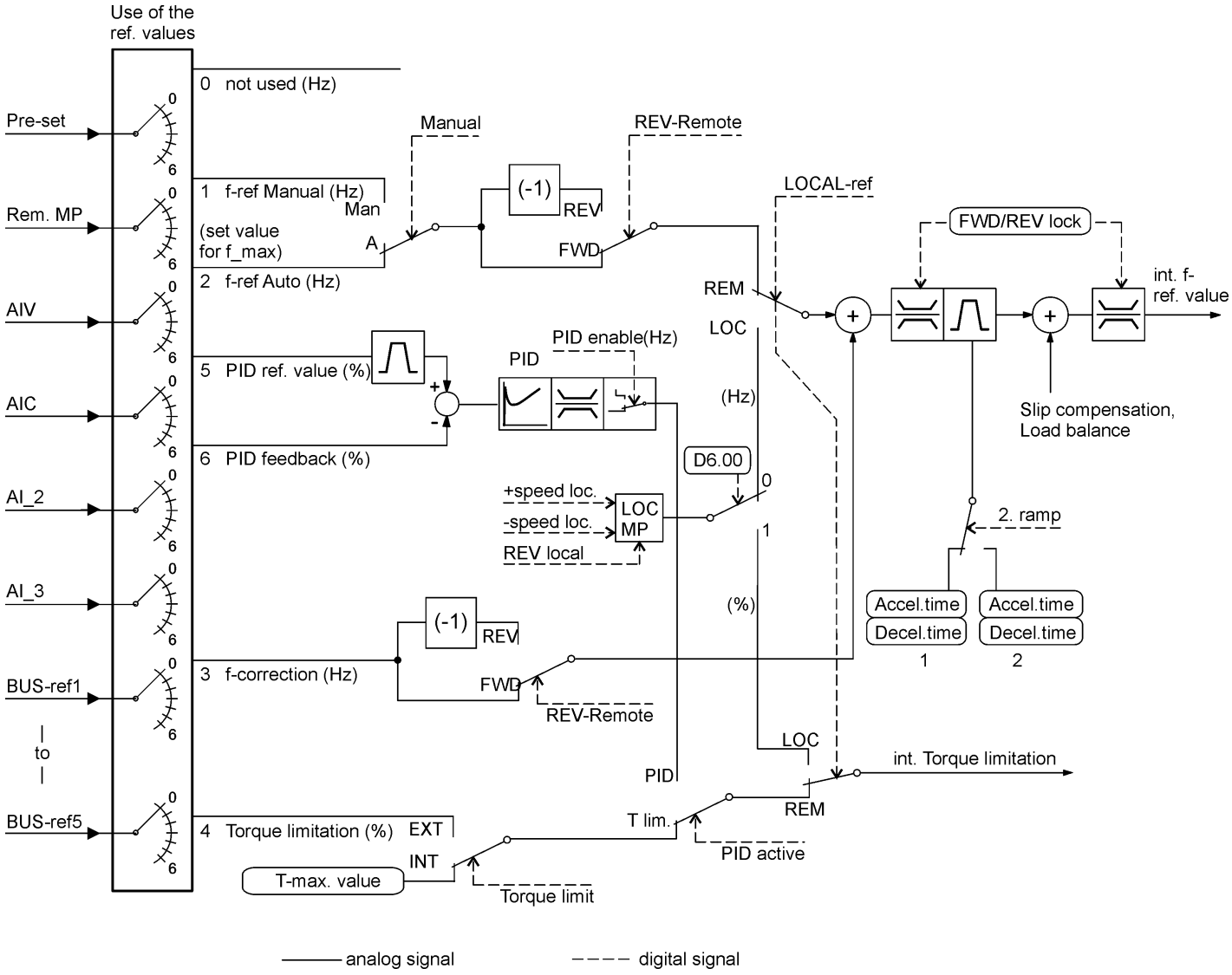
PID Speed controller

Instead of using the PID controller for control of an external process, it can be also used as a speed controller (a slow speed controller). Therefore, parameter C4.04 must be set to position 3 or 4.
Typical applications are slow-turning unbalance drives like oil pumps, saws and presses. By using this function, an even current consumption is achieved - and therewith a low mains load.
Therefore, the internal connections of reference values for frequency and torque are changed.

<u>Wiring and adjusting example:</u>

- Set one analog output to "Output frequency" or "Speed" and connect it with an analog input (PID feedback). Now the filter time for the input can be set e.g. to 0.2 s.
- Set the parameters of the PID controller T_N to appr. 4x filter time and also adjust kp.
- Adjust the positive and negative limitation of the PID controller output (e.g. C4.11 = 213 Hz (= 130 %); C4.10 = 0).
- The reference value is given by pre-set reference 1, for example. For the PID reference value the Remote-motorpotentiometer or another analog input can be used.

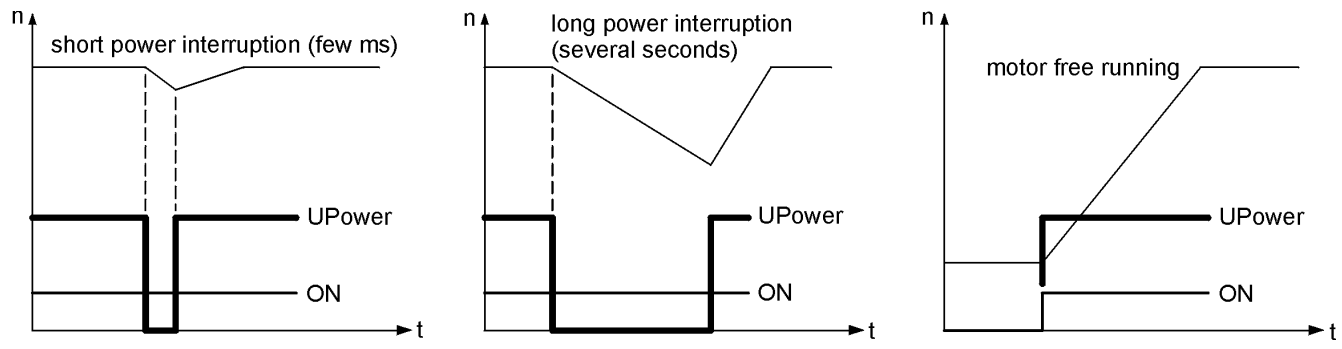
The parameters C4.03, C4.10 and C4.11 must be set in Hz and have to be calculated in accordance with: 163.84 Hz = 100 %.



C5 — Catch on the fly

Due to the innovative control concept AVC (Auto Vector Control) in conjunction with the modulation process FMC (Flux Mode Control), the frequency inverter is able to pick up to a phase and speed synchronous free-wheeling motor in less than 0.1 s. However, this is only possible if a connection between the inverter and the motor exists.

Regardless of the duration of the power failure (e.g. some 100 ms to several seconds), this intercept function guarantees a safe and immediate start even during free-wheeling motor operation, starting from the current motor speed.



For motors, which are not switched onto the inverter output yet, the Start command (intercept function) must be activated approx. 3...5 seconds later!
If the Start command is issued earlier, the inverter will brake a running motor down to approx. 0 Hz and then accelerate it to the set reference value.

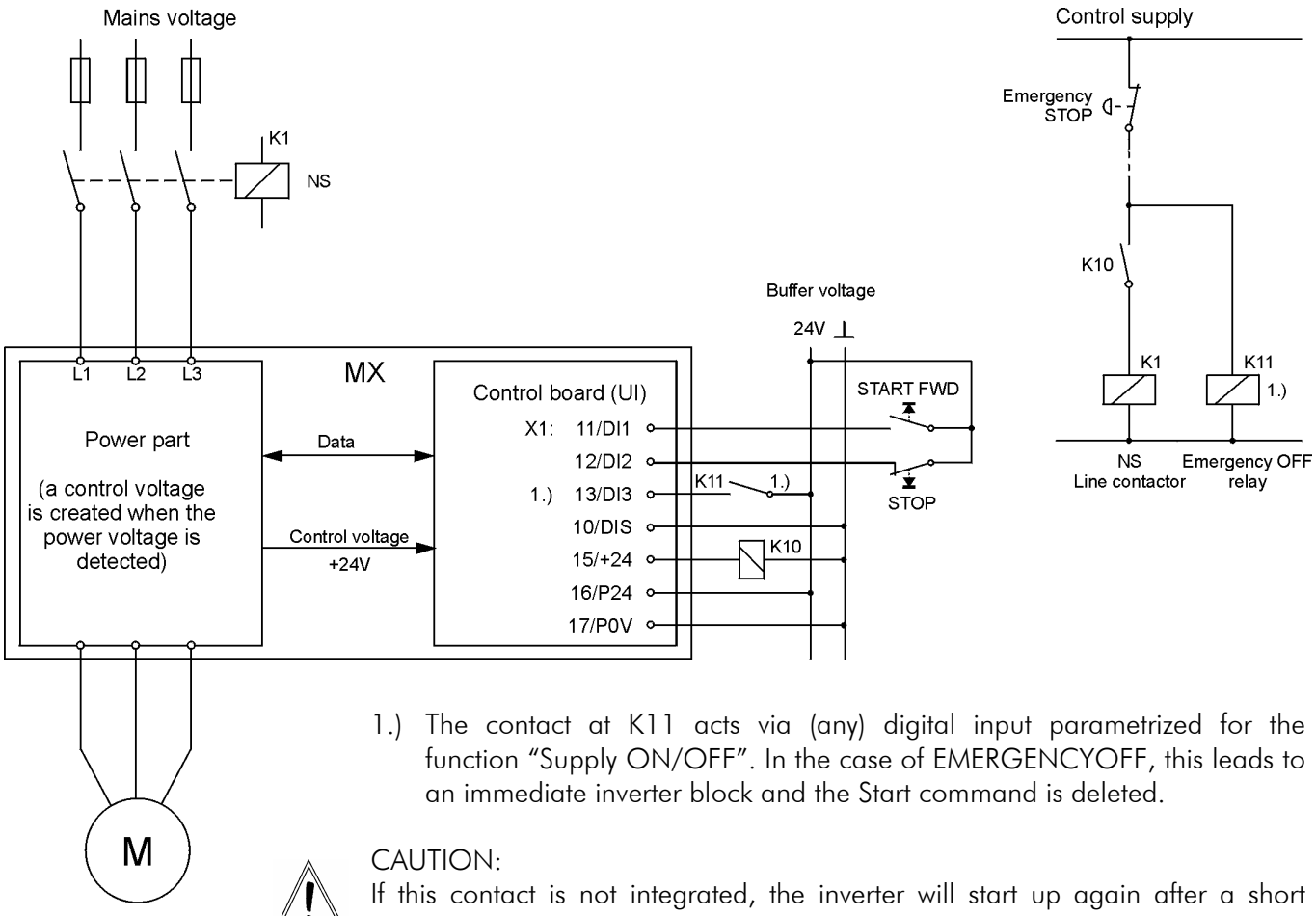
C5.00	Detection level	VCB	0.4...***0.6***...15.0 %

This parameter represents the sensitivity of the speed detection. If C6.01 is set to "Hoist" or "Traverse" or if parameter D5.00 "Encoder/Slip compensation" is set to "2...Encoder", the detection level is automatically set to 12% (reduced sensitivity).

C6 f_{xx}

C6.00	Contactor control	VICB	not active

0 ... not active •
1 ... active



1.) The contact at K11 acts via (any) digital input parametrized for the function "Supply ON/OFF". In the case of EMERGENCYOFF, this leads to an immediate inverter block and the Start command is deleted.

CAUTION:
If this contact is not integrated, the inverter will start up again after a short EMERGENCY-OFF (as with a steady on command)!

If the inverter electronics are supplied by an external 24 V buffer voltage, it is possible to activate the special function "Contactor control". Thereby, a selectable digital output (see D4) is activated with every Start command (via keypad, terminals or bus), which controlls the line contactor. The "Ready" message is issued as soon as the control voltage (24 V) is applied.
If the mains voltage (intermediate circuit voltage) does not reach its nominal value within 3 s (12 s for MX size A and B), a trip follows with the message "Undervoltage 2".

Possible causes are:

– Digital output is not parametrized correctly
– Line contactor does not close
– Mains fuses are defect or
– Inverter charging circuit is defect

Every time the pulse inhibit state occurs (OFF command after deceleration or trip), the current to the inverter power part is switched off by the line contactor.
"Mains OFF" is displayed in the matrix area HOME (A1).

C6.01	Crane function	VICB	not active

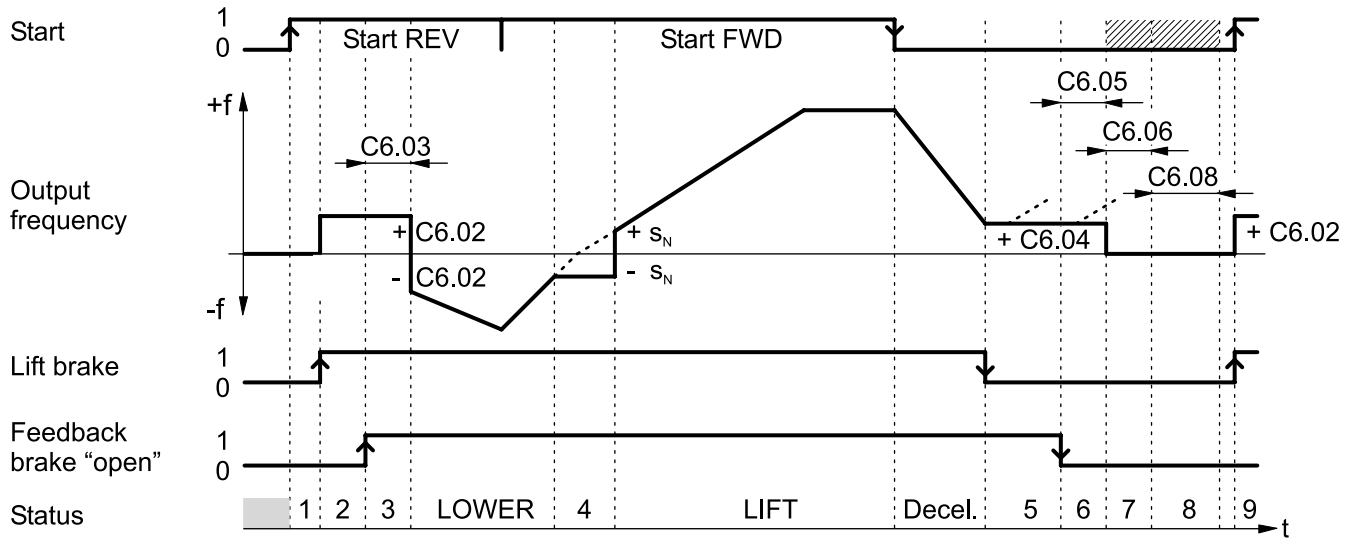
0 ... not active •
1 ... Hoist
2 ... Traverse

The brake control needed for the crane function is optimized specifically for hoist or traverse functions by selecting the parameter C6.01.
The signal for brake control is applied at the terminal strip once a digital output (parameter D4.xx set to "Lift brake") has been programmed accordingly.

If "Hoist" or "Traverse" is selected, some parameters are automatically changed:

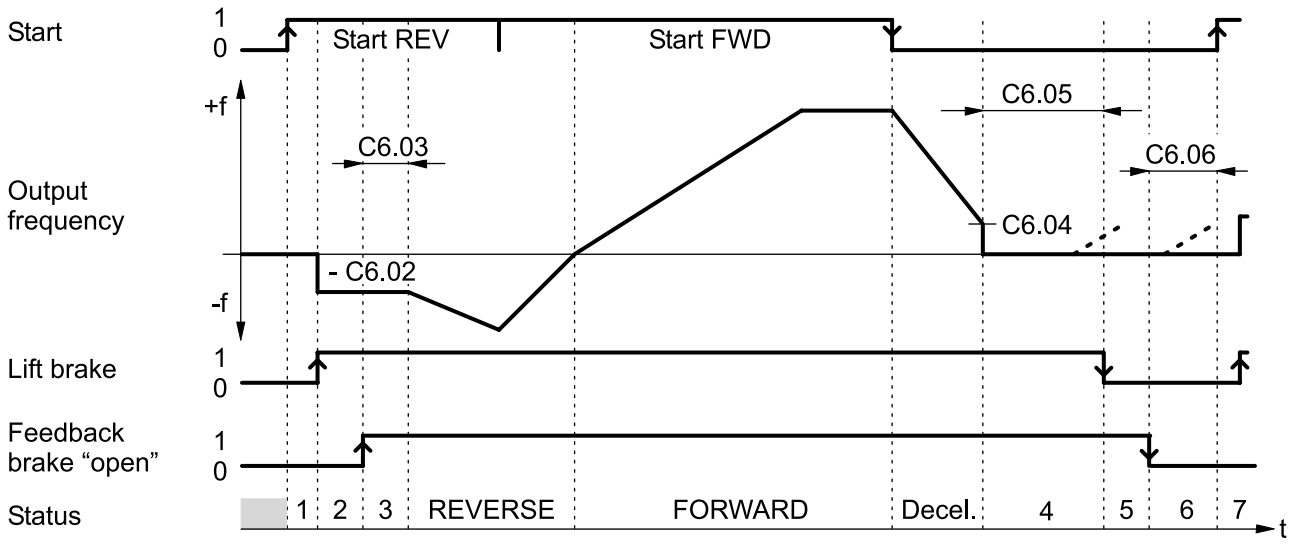
- C5.00 "Detection level" is automatically set to 12%
- E3.21 "Undervoltage Response" is set to "1 Trip at run"
- E3.22 "Undervoltage time delay" is set to 0s and
- E3.23 "Inverter Temp. Response" is automatically set to "1 I-limitation to 110%".

Schematic "Hoist":



1 Magnetizing phase (time 100...300 ms is set automatically)
2 Time from command "Lift brake" to feedback "Brake open" (not applicable, if no feedback contact is used)
3 Adjustable "Release time" until brake is fully open
4 Automatic frequency masking with ± nominal slip frequency (only hoists without encoder)
5 Time from command "Close brake" until feedback "Brake closed" (not applicable, if no feedback contact is used)
6 Adjustable "Engage time" until brake starts to close (restart possible without delay)
7 Adjustable "DC braking time" until brake is fully closed (restart not possible for hoists without encoder)
8 Delay time for restart (only for hoists with encoder)
9 Restart
------ Output frequency curve for deviating control commands

Schematic "Traverse":



1 Magnetizing phase (time 100...300 ms is set automatically)
2 Time from command “Lift brake” to feedback “Brake open” (not applicable, if no feedback contact is used)
3 Adjustable “Release time” until brake is fully open
4 Adjustable “Engage time” during which a restart is possible without addressing the brake
5 Time from command “Close brake” until feedback “Brake closed” (not applicable, if no feedback contact is used)
6 Adjustable “DC braking time” until brake is fully closed (restart possible without delay)
7 Restart

Recommended parameter settings

GENERAL

Operating mode	Frequency control	Encoder mode	Speed control mode
Encoder	–	necessary	necessary
Option SFB	–	necessary	necessary
D5.00 "encoder/slip comp."	"0 no encoder"	"2 encoder"	"2 encoder"
D5.02 "speed controller active"	"0 not active"	"0 not active"	"1 active"
D5.03 "pulse/rotation"	–	Setting in accordance with encoder	Setting in accordance with encoder
D5.04 to D5.11	–	–	Settings necessary 1.)
Crane overload protection active with	Calculated speed	Measured speed	Measured speed
Frequency phase-out at 0 Hz	± nominal slip	no	no
Lowest speed	2.5 Hz (5% of n_N)	2.5 Hz (5% of n_N)	0 rpm

HOIST

Operating mode	Frequency control	Encoder mode	Speed control mode
Delay on restart	necessary	no delay	no delay
C6.01 "Crane function"	"1 Hoist"	"1 Hoist"	"1 Hoist"
C6.02 "Release frequency"	1.2...1.5 x nominal motor slip	1.0...1.3 x nominal motor slip	0.1..0.4 x nominal motor slip
C6.03 "Release time"	in accord. with brake release time (or 0.0...0.5 s with feedback contact)		
C6.04 "Engage frequency"	1.1...1.4 x nominal motor slip	1.0...1.2 x nominal motor slip	0.0 Hz
C6.05 "Engage time"	in accord. with brake application time (or 0.0...0.5 s with feedback contact)		
C6.06 "DC braking time" C6.07 "DC braking current"	0.0...0.5 s with 0%...residual field or 0.5... 2 s with 80...120% as required	0.0...0.5 s DC brake not active	0.0...0.5 s DC brake not active
C6.08 "Restart delay"	0.5...2.0 s (depending on motor size)	0.0 s	0.0 s
C6.09 "Hoist mode"	yes / no (depending on crane design)	yes / no (depending on crane design)	no
C6.10 "max. n-error"	5...15 Hzs (depending on dynamic requirements)		

TRAVERSE

Operating mode	Frequency control	Encoder mode	Speed control mode
Delay on restart	no delay	no delay	no delay
C6.01 "Crane function"	"2 Traverse"	"2 Traverse"	"2 Traverse"
C6.02 "Release frequency"	1.2...1.5 x nominal motor slip	1.0...1.2 x nominal motor slip	0.1...1.4 x nominal motor slip
C6.03 "Release time"	in accord. with brake release time (or 0.0... 0.5 s with feedback contact)		
C6.04 "Engage frequency"	0.5...1.0 x nominal motor slip	0.0 Hz	0.0 Hz
C6.05 "Engage time"	0.0...15.0 s positioning time (brake still released)		
C6.06 "DC braking time"	0.1…1.0 s; in accord. with brake application time (or 0.0...0.5 s with feedback contact)		
C6.07 "DC braking current"	40...80%	–	–
C6.08 "Restart delay"	–	–	–
C6.09 "Hoist mode"	–	–	–
C6.10 "max. n-error"	10...50 Hzs (depending on dynamic requirements)		

1.) The speed controller should be set without load. The "additional" hoisting load usually improves the control behavior.
Parameter tuning should be performed in the following order: D5.07 "Act. value PT1 time", D5.05 "speed controller Tn" and D5.04 "speed controller Kp".

C6.02	Release frequency	VCB	0.0...***1.7***...20.0 Hz

This parameter sets the frequency that is applied to the motor during the brake release time.

1.) In hoists without speed feedback, the "release frequency" must not be lower than the slip frequency of the motor!
2.) Furthermore, the lowest frequency reference value should be higher than the release frequency.

C6.03	Release time	VCB	0.0...***0.3***...160.0 s

The "release time" should be set slightly longer than the brake release time. If a brake feedback contact is integrated, a small additional delay can be set.

C6.04	Engage frequency	VCB	0.0...***1.5***...20.0 Hz

This parameter sets the frequency that is applied to the motor during the brake application time.
In traverse, this is the frequency at which the positioning time ("engage time") starts.

C6.05	Engage time	VCB	0.0...***0.3***...160.0 s

The "Engage time" should be set slightly longer than the brake application time. If a brake feedback contact is integrated, a small additional delay can be set.
During the engage time, a restart is possible at any time, even in hoist mode without speed feedback.
In traverse, this sets the positioning time until the signal "Close brake".

C6.06	DC braking time	VCB	0.0...***0.3***...160.0 s

Setting for the "DC braking time" in addition to the engage time until the brake is fully applied.
In hoists without encoder, a restart is not possible until the "DC braking time" and the "Restart delay" have elapsed.
In traverse applications, this parameter must be set in accordance with the brake application time.

C6.07	DC braking current	VCB	0...***100***...150 % $I_{N"C"}$

With a "DC braking time" lower than 0.5 s, it is advantageous to set the "DC braking current" to "0". This achieves the greatest braking torque. For a longer "DC braking time", the best setting is in the range from 80...100%.
(In drives with encoder, this parameter has no function.)

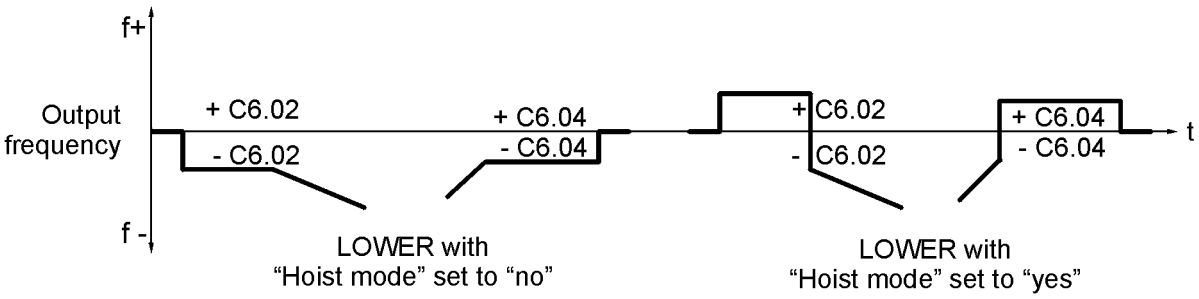
C6.08	Restart delay	VCB	0.0...***0.7***...10.0 s

The frequency inverter *>pDRIVE< MX* is able to take over the full hoisting load from the brake perfectly, whereby it controls this independently after building up the magnetic field with the output "lift brake". In order to guarantee this even for drives without a shaft encoder, a minimum timeout is necessary after every switch to pulse inhibit.
A renewed start command is not executed until after the set "restart delay".
In traverse mode, this parameter has no function.

C6.09	Hoist mode	VCB	no

0 ... no • Recommended setting for hoists with counterweight (or long braking times).
1 ... yes The inverter always starts with forward rotation, thus counteracting the load. The lowering process does not start until the "restart time" has elapsed.

In traverse mode, this parameter has no function.



When using the function "hoist mode", the crane drive must be switched the way that FWD (on the inverter) is equivalent to lifting the load!

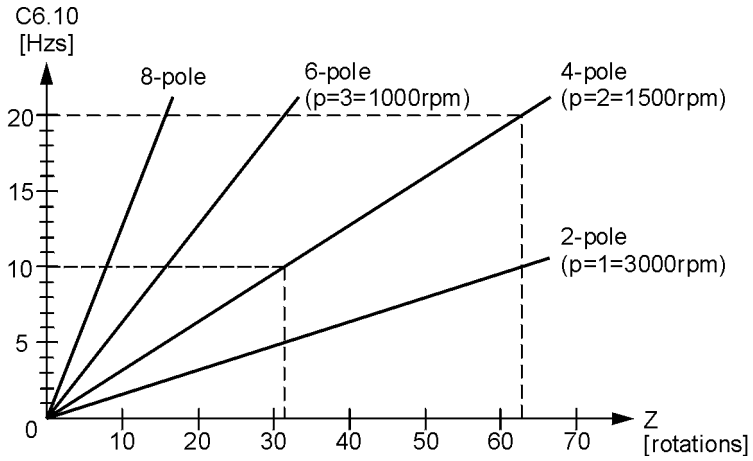
C6.10	Max. n-error	VCB	0...***5***...300 s

The sensitivity of the protection function "Crane overload" is set using this parameter.
Protection is provided by monitoring the difference between the frequency ref. value after the ramps and the actual stator frequency with regard to time.
The cut-off criterion is the maximum deviation in Hzs defined in parameter C6.10, which corresponds to the max. permissible angle of rotation. This depends on the number of motor pole pairs:

$$Z = \frac{2\pi \cdot [C6.10]}{p}$$

Z ... revolutions
p ... number of pole pairs

This monitoring function is disabled, if the value for parameter C6.10 is set to 0.



If this parameter is to be used, C6.01 "Crane function" must not be set to the default "not active"!

C6.11	Fast speed	VCB	not active

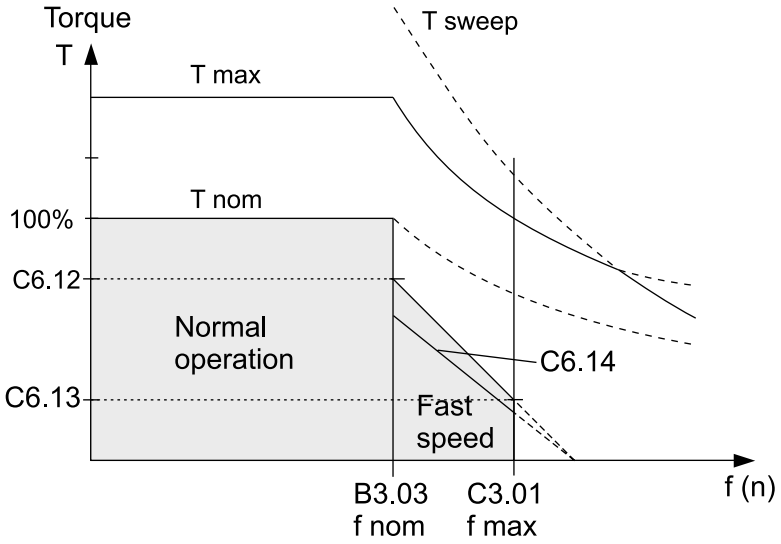
0 ... not active •
1 ... active

C6.12	T max. at f-nom.	VCB	10.0...***70.0***...200.0 %
C6.13	T max. at f-max.	VCB	10.0...***30.0***...100.0 %
C6.14	Reduction at Down	VCB	10.0...***50.0***...100.0 %

For hoist and traverse applications, this functions allows a "Fast speed" at low load. Therefore, parameter C6.12 defines the maximum torque. C6.13 sets the allowed torque at fmax (C3.01).

For the lowering process an additional reduction of the torque limit is adjustable by C6.14 "Reduction at Down".

A possibility to reach "Fast speed" at a drive, is the adjustment (summation) of a pre-set reference via the "f-correction" reference path.



For calculating the static lifting and lowering power, it is necessary to set parameter B3.07 "Inertia" correctly.
(A too high value can lead to switch-off with crane overload. If the value is too low, the acceleration to maximum speed is delayed.)

Select the braking resistors carefully !
The braking power increases in relation to speed square !

The deceleration time is extended according to the higher speed and maybe additionally by the reduced overload ability. This effect can be balanced by switch-over to 2nd deceleration ramp, if required.

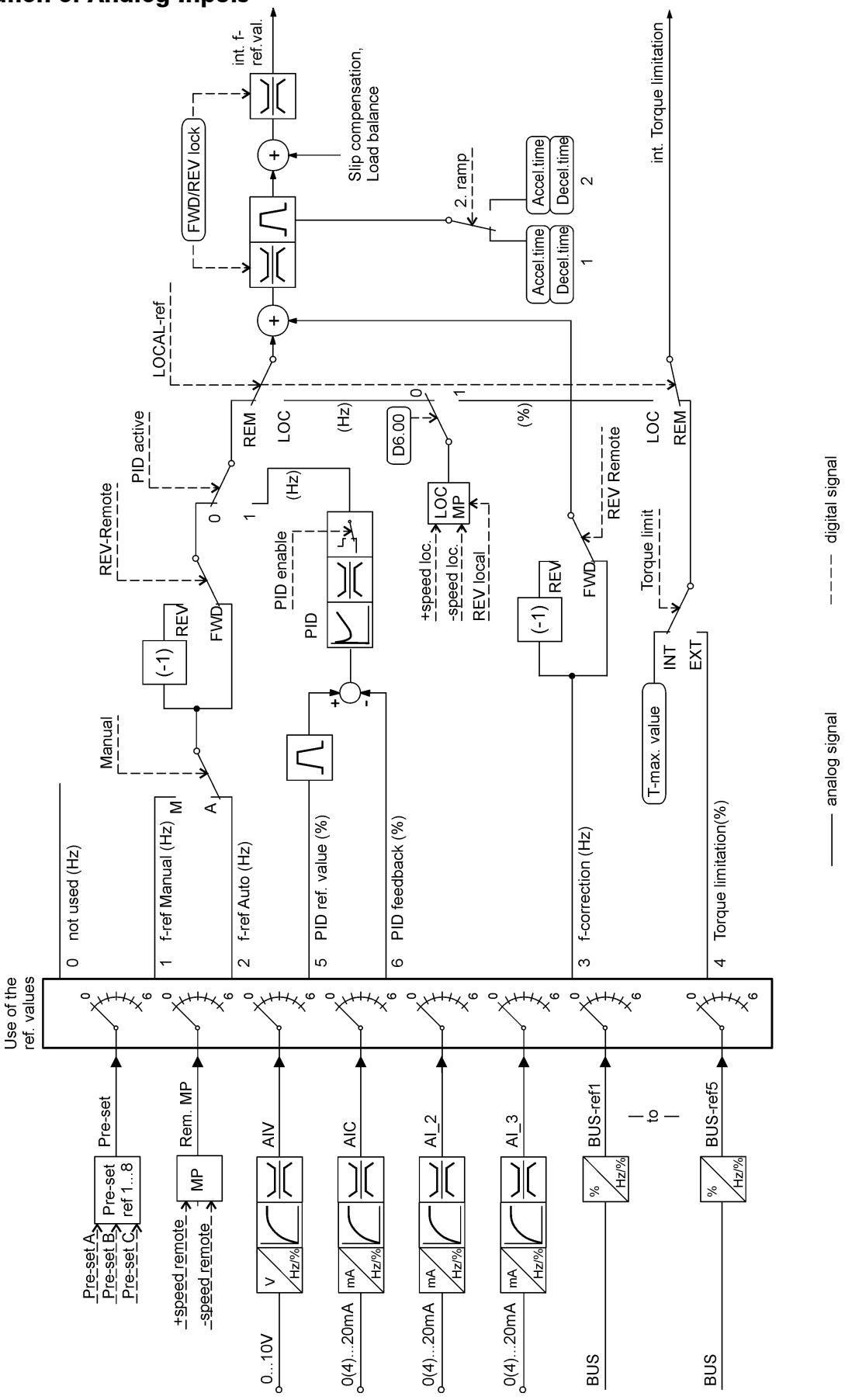
This function does not work in combination with active n-control ("Speed control mode" if D5.02 is set to 1…4), but it operates during "Encoder mode" (D5.02 = 0).

Remarks for field weakening operation:

>pDRIVE< MX frequency inverters calculate the sweep torque of the motor using the adjusted motor data (nom. speed B3.04, nom. power B3.00, …) and the measured motor data (autotuning data B4). A too high load torque (in relation to the frequency) leads to current limitation and therefore to reduction of the output frequency.

→ **To avoid trigger of crane monitoring (C6.10 "Max. n-error") the max. output frequency must not be set too high !**

Configuration of Analog Inputs



D1.00	AIV selection	VICB	not used (see Macro)

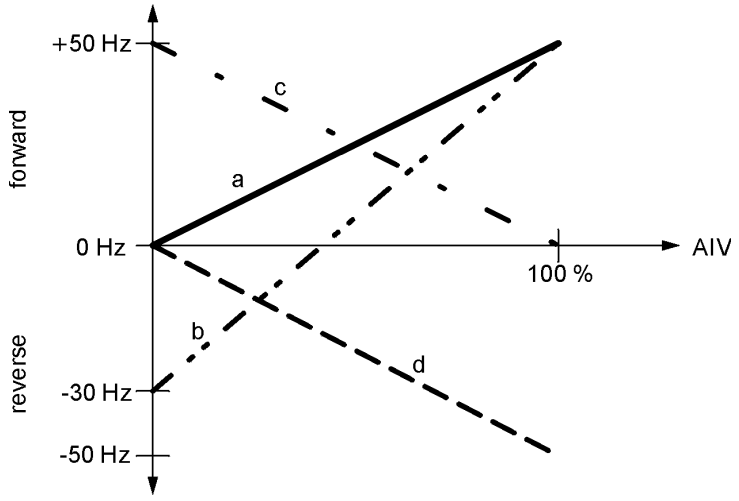
0 .... not used • Hz
1 .... f-ref Manual Hz
2 .... f-ref Auto Hz
3 .... f-correction Hz
4 .... T-limitation %
5 .... PID reference %
6 .... PID feedback %
7 .... DMA f-balance see parameters D5.13...16
8 .... DMA T Master see parameters D5.13...16

If individual settings cannot be selected, they have already been assigned by one of the other reference value sources or by a bus reference value!

As shown in the figure overleaf, the analog ref. value AIV (0-10 V) serves as a source for various reference values. The relevant function is assigned to the analog input using parameter D1.00.

D1.01	AIV value 0 %	VCB	-300.00...***0.01***...300.00 Hz (see -200.00...***0.01***...200.00 % Macro)
D1.02	AIV value 100 %	VCB	-300.00...***50.01***...300.00 Hz (see -200.00...***30.52***...200.00 % Macro)

With the AIV level, a frequency range is assigned to the analog input signal (0...10V). Negative frequencies correspond with reverse on the frequency inverter output.



a ... 0-100% corresponds with 0 to 50 Hz
b ... 0-100% corresponds with -30 to 50 Hz
c ... 0-100% corresponds with 50 to 0 Hz
d ... 0-100% corresponds with 0 to -50 Hz

D1.03	AIV filter time	VCB	0.00...***0.05***...10.0 s

In order to suppress undesired interference or radio frequency interference, the digital ref. value filter can be programmed.

D1.04	AIC selection	VICB	f-ref Auto (see Macro)

0 .... not used Hz
1 .... f-ref Manual Hz
2 .... f-ref Auto • Hz
3 .... f-correction Hz
4 .... T-limitation %
5 .... PID reference %
6 .... PID feedback %
7 .... DMA f-balance see parameters D5.13...16
8 .... DMA T Master see parameters D5.13...16

If individual settings cannot be selected, they have already been assigned by one of the other reference value sources or by a bus reference value!

The function of the analog ref. value AIC corresponds with the ref. value AIV, except that it is a current signal 0(4)-20 mA.

D1.05	AIC level	VCB	4-20 mA monitored

0 ... 0-20 mA
1 ... 4-20 mA monitored • monitoring of the analog signal to ≤3 mA
2 ... 4-20 mA ignored no monitoring

To monitor the 4-20 mA "LiveZero" signal for wire breakage, parameters E3.03 to E3.05 must be set accordingly!

D1.06	AIC value 0 %	VCB	-300.00...***0.01***...300.00 Hz (see -200.00...***0.01***...200.00 % Macro)
D1.07	AIC value 100 %	VCB	-300.00...***50.01***...300.00 Hz (see -200.00...***30.52***...200.00 % Macro)
D1.08	AIC filter time	VCB	0.00...***0.05***...10.00 s

The function of the parameters D1.04...D1.08 is identical with the function of parameters D1.00...D1.03 and is described there.

D1.09	AI_2 selection	VICB	not used (see Macro)

0 .... not used • Hz
1 .... f-ref Manual Hz
2 .... f-ref Auto Hz
3 .... f-correction Hz
4 .... T-limitation %
5 .... PID reference %
6 .... PID feedback %
7 .... DMA f-balance see parameters D5.13...16
8 .... DMA T Master see parameters D5.13...16

If individual settings cannot be selected, they have already been assigned by one of the other reference value sources or by a bus reference value!

The analog ref. value AI_2 corresponds with the 0(4)...20 mA ref. value on the differential amplifier input of the option card IO1 in slot X2. It has the same function as the ref. value AIC.

D1.10	AI_2 level	VCB	0-20 mA

0 ... 0-20 mA •
1 ... 4-20 mA monitored monitoring of the analog signal to ≤3 mA
2 ... 4-20 mA ignored no monitoring

To monitor the 4-20 mA "LiveZero" signal for wire breakage, parameters E3.03 to E3.05 must be set accordingly!

D1.11	AI_2 value 0 %	VCB	-300.00...***0.01***...300.00 Hz (see -200.00...***0.01***...200.00 % Macro)
D1.12	AI_2 value 100 %	VCB	-300.00...***50.01***...300.00 Hz (see -200.00...***30.52***...200.00 % Macro)
D1.13	AI_2 filter time	VCB	0.00...***0.05***...10.00 s

The function of the parameters D1.09...D1.13 is identical with the function of parameters D1.00...D1.03 and is described there.

D1.14	AI_3 selection	VICB	not used

0 .... not used •
1 .... f-ref Manual Hz
2 .... f-ref Auto Hz
3 .... f-correction Hz
4 .... T-limitation %
5 .... PID reference %
6 .... PID feedback %
7 .... DMA f-balance see parameters D5.13...16
8 .... DMA T Master see parameters D5.13...16

If individual settings cannot be selected, they have already been assigned by one of the other reference value sources or by a bus reference value!

The analog ref. value AI_3 corresponds with the 0(4)...20 mA ref. value on the differential amplifier input of the option card IO1 in slot X3. It has the same function as the ref. value AIC.

D1.15	AI_3 level	VCB	0-20 mA

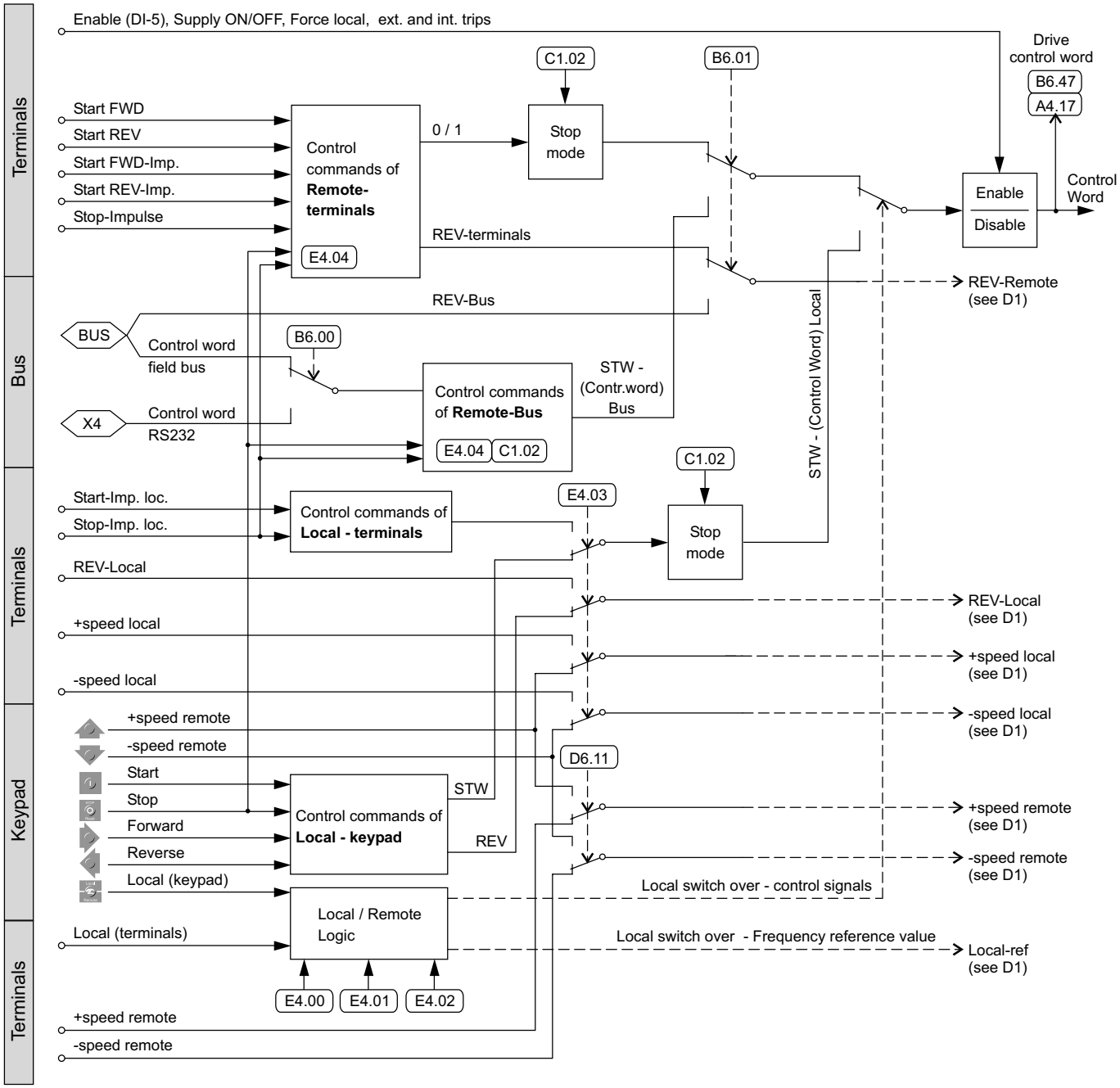
0 ... 0-20 mA •
1 ... 4-20 mA monitored monitoring of the analog signal to ≤3 mA
2 ... 4-20 mA ignored no monitoring

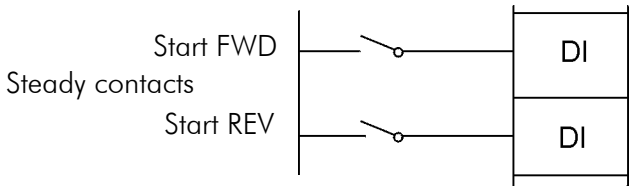
To monitor the 4-20 mA "LiveZero" signal for wire breakage, parameters E3.03 to E3.05 must be set accordingly!

D1.16	AI_3 value 0 %	VCB	-300.00...***0.01***...300.00 Hz (see -200.00...***0.01***...200.00 % Macro)
D1.17	AI_3 value 100 %	VCB	-300.00...***50.01***...300.00 Hz (see -200.00...***30.52***...200.00 % Macro)
D1.18	AI_3 filter time	VCB	0.00...***0.05***...10.00 s

The function of the parameters D1.14...D1.18 is identical to that of parameters D1.00...D1.03 and is described there.

Overview "Control commands"

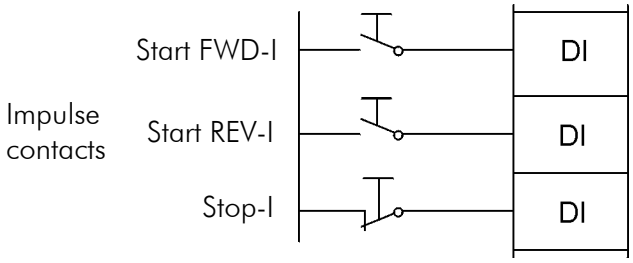




Start/Stop using steady contacts

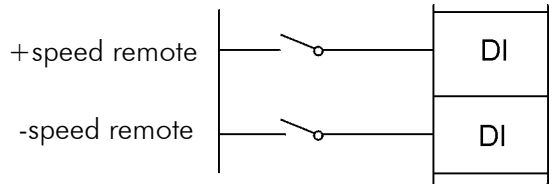
Making contact activates the Start command in the desired direction, breaking contact means Stop. The simultaneous making of Start FWD and Start REV also stops the motor.

An active Start command is not influenced internally → restart after reset.



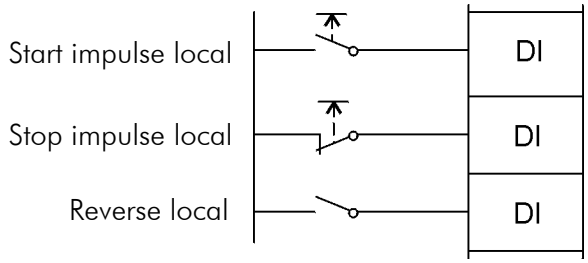
Start/Stop using impulse contacts

An impulse signal (make contact) activates the Start command in the desired direction. An impulse signal (break contact) activates the Stop command. When pulse enable is switched off in the event of a trip shutdown, and after continued undervoltage (time can be set using parameter E3.22), the ON command is deleted automatically. A new Start impulse is required.



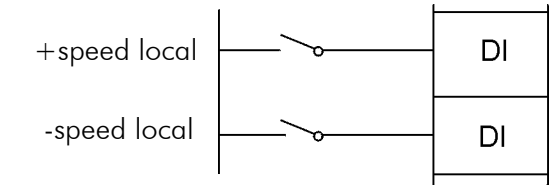
Remote motorpotentiometer

Reference standardization via the remote motor potentiometer is achieved using the switch signals "+speed remote" and "-speed remote".
Thereby, the reference value is raised or lowered according to the set acceleration/deceleration ramp as long as the command is active. The motor potentiometer can be configured in matrix area D6.



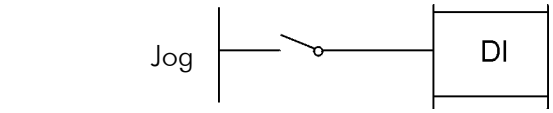
Start / Stop local control

The digital signals replace keys I, O, ← and → on the keypad local → operation via the terminal strip.
In addition to parametrization of the digital inputs (2 or 3), please note the settings for parameters E4.00 to E4.03.



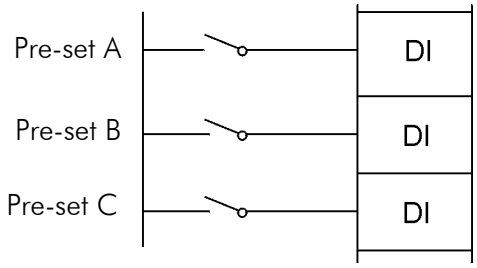
Local motor potentiometer

The digital signals replace the function of the ↑↓ keys on the keypad.
Configuration of the local motorpot: see D6.00 to D6.04 and E4.00, 01 and 03.



Jog mode

If the jog command is active, the inverter accelerates the motor with the fastest possible acceleration time to the set jog frequency C1.15. The jog function is only possible during stopped state.



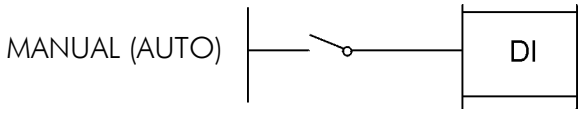
How many digital inputs have to be programmed depends on the required number of pre-set ref. values. They are programmed in matrix area C1. The pre-set ref. values are pure ref. values and do not contain any Start/Stop commands.

Pre-set values

The max. 8 pre-set ref. values are selected with the signals Pre-set A...C as shown in the following table:

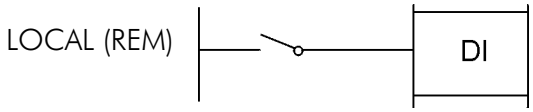
A	B	C	Ref. value
0	0	0	1 (C1.07)
1	0	0	2 (C1.08)
0	1	0	3 (C1.09)
1	1	0	4 (C1.10)
0	0	1	5 (C1.11)
1	0	1	6 (C1.12)
0	1	1	7 (C1.13)
1	1	1	8 (C1.14)

The digital inputs are also active in bus control mode.



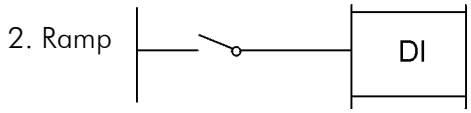
MANUAL (AUTO) switch-over

The command MANUAL(AUTO) switches between the two ref. value sources "f-ref Manual" and "f-ref Auto".
Break contact or command not used: AUTO,
make contact: MANUAL.
The digital input is also active in bus control mode.



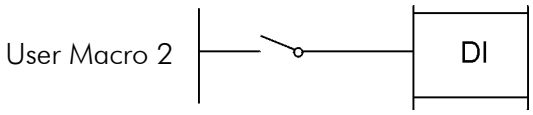
LOCAL(REM) switch-over

The LOCAL(REM) switch defines whether the unit is controlled using the keypad (or digital command "Local"), or the terminals (or bus). By default, the switch-over is performed using the LOC/REM key on the keypad. If "terminals" is selected for parameter E4.02, the switch-over is only possible using a digital input (e.g. using a key-operated switch).
Break contact or command not used: REM,
make contact: LOC.
The digital input is also active in bus control mode.



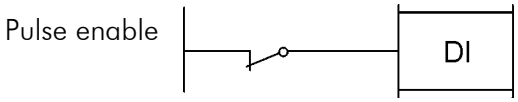
Ramp switch-over

2 sets of acceleration/deceleration ramps are available. The signal "2.Ramp" is used to switch between these sets of ramps. The values for the acceleration and deceleration times are set in matrix area C2.
Make contact: Ramp 2.
The digital input is also active in bus control mode.
The digital input is running in parallel to parameters C2.06 and C2.07.



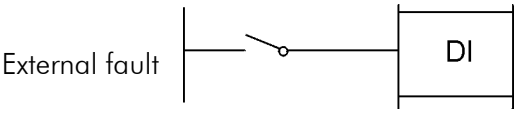
2. Parameter Set = User Macro2

If parameter B2.04 is set to "1" or "2" depending on the DI, this input means at LOW (0 V) that the parameter values of User Macro1 and at HIGH (24 V) the parameter values of User Macro2 are loaded.
The parameters are only accepted with pulse inhibit!
The digital input is also active in bus control mode.



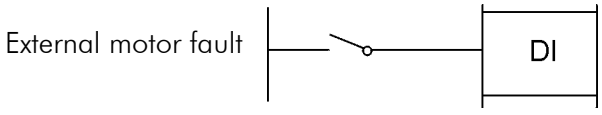
Enable

Opening the switch "Enable" via the programmable terminal or via the hardware input DI5_2 leads to an immediate pulse inhibit in the power part of the motor. Any ON command stored via impulse contacts is deleted. The display shows: Disabled. Function not parametrized or make contact: Enable.
The digital input is also active in bus control mode.



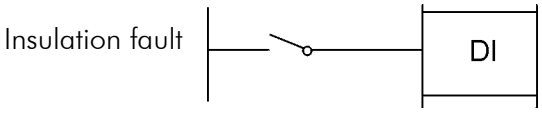
External fault

An active command leads to trip shutdown with the error code "External fault" or creates an alarm message. The reaction time is adjustable. Errors in the system can be integrated in the inverter controls using this input. The trip message can be realized by means of break or make contacts (selected using E3.11 to E3.13).
The digital input is also active in bus control mode.



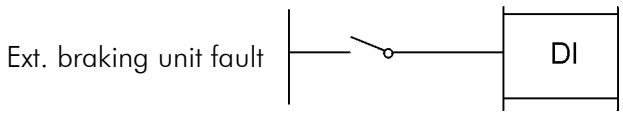
External motor fault

The mode of action is the same as for an external trip, but the trip code indicates a motor trip. This command is used for bearing temperature monitoring, vibration monitoring devices, or motor temperature monitoring with Click-Therm. The reaction time of the trip message is adjustable and can be realized by break or make contacts (selected using E2.13 to E2.15).
The digital input is also active in bus control mode.



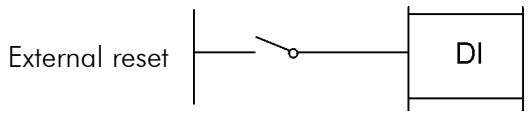
Insulation fault

An active command leads to immediate shutdown with the trip code "Insulation fault" or creates an alarm message. The reaction time is adjustable up to 160 s. Using this input, an external trip voltage monitor (for ungrounded mains) or the comparator output using the option "Earth protection 1 and 2" can be integrated (see parameters E3.18 to E3.20).
The digital input is also active in bus control mode.



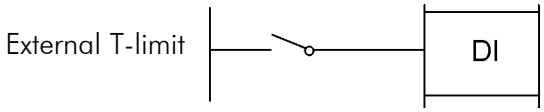
External braking unit fault

Same mode of action as "Ext. fault", but with the display "Ext. BS fault" to integrate a braking unit trip in the inverter (see parameters E3.09 and E3.10).
The digital input is also active in bus control mode.



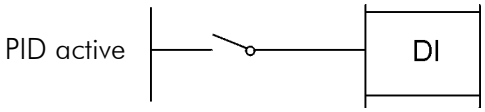
External reset

Allows confirmation of a trip via the terminals.
Reset for ON flank: no effect on an inverter that is running.
The digital input is also active in bus control mode.



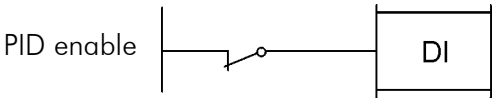
External torque limitation

When this function is activated, the maximum torque is limited to an externally defined value. The value is defined by a separate ref. value source (see D1). If the torque exceeds the set limit, the drive will react with a speed deviation.
Break contact or command not used: T-max. value (E1.01) active
Make contact: ext. T-limit activated.
The digital input is also active in bus control mode.



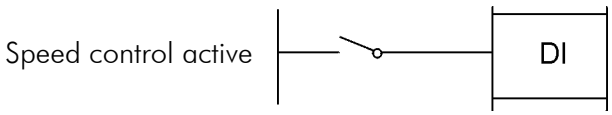
PID active

This input allows a controlled switch-over between frequency control and PID control.
Break contact: switch-over from PID control to frequency control
Make contact (or input not used): PID controller active, the switch-over is vibrationless
The digital input is also active in bus control mode.



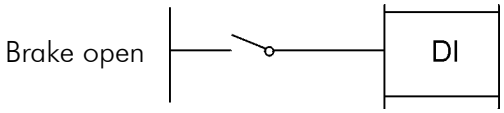
PID controller enable

This function allows the internal process controller to be enabled via the terminals.
Break contact: PID controller output is frozen at the last value.
Make contact or not used: PID enabled.
The digital input is also active in bus control mode.



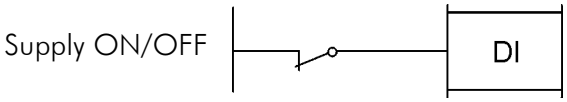
Speed controller active

This input allows controlled switch-over between frequency control and speed control (with speed feedback).
Break contact: frequency control
Make contact (or input not used): speed control active
The digital input is also active in bus control mode.



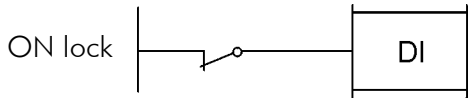
Brake open

This input activates the feedback from the mechanical brake in hoist and traverse drives.
Break contact: brake is closed
Make contact (or input not used): brake is open
The digital input is also active in bus control mode.



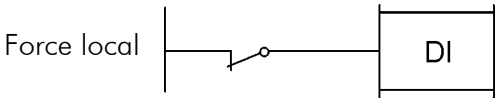
Supply ON/OFF

Leads to an immediate pulse inhibit and thus to mains disconnection. Used for EMERGENCY OFF and mains disconnection signals.
Break contact: immediate pulse inhibit and subsequent mains disconnection, display shows: "Mains disc.".
The digital input is also active in bus control mode.



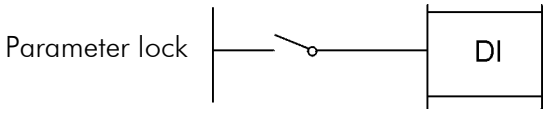
ON lock

This input is used to integrate monitoring units in the cubicle (mains fuses, contactor, load switching monitor, fan monitor, etc.)
Make contact (or input not used): no trip
Break contact: trip message, shutdown and "ON lock" appears in the display.
The digital input is also active in bus control mode.



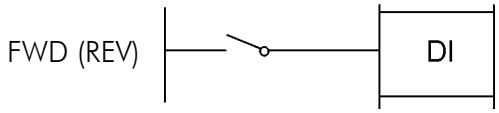
Force local

This function allows cut-off for operation of the frequency inverter during remote mode.
Break contact: operation possible only in local mode (remote → pulse inhibit and message on display: "Local only").
Make contact: operation possible in both modes (local and remote).
The digital input is also active in bus control mode.



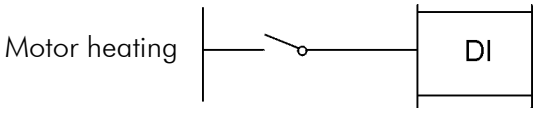
Parameter lock

This function allows an additional lock for parametrization via the terminals. Thus, it is possible e.g. to lock parametrization via an external key-operated switch.
Break contact: parametrization enabled
Make contact: parametrization locked
The digital input is also active in bus control mode.



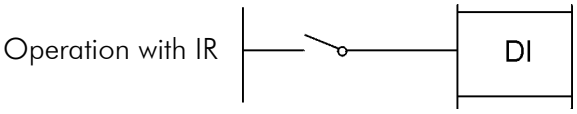
Forward (reverse)

This function allows the inverting of the frequency reference signal in case of bus control mode.
Break contact or command not used: no inverting
Make contact: the transmitted frequency value will be inverted.



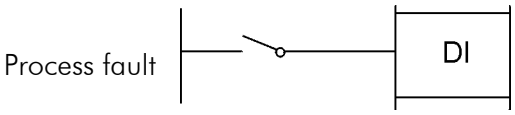
Motor heating

The input starts a current flow into the motor to heat the motor and thus to avoid condensation (15 % of the nom. motor current).
The motor heating function is only possible during stopped state.
ATTENTION: The motordata B3 must be set correctly !



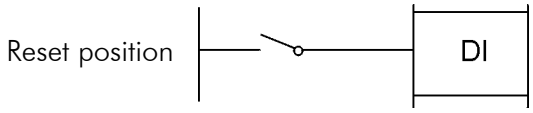
Operation with IR (Intelligent Rectifier)

This input activates the software changes for running with IR (Intelligent Rectifier).
Make contact: Running with IR
Break contact: Standard setting for 3 AC mains supply



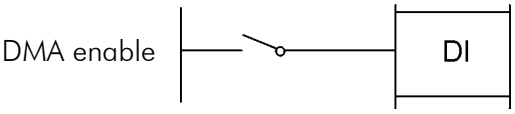
Process fault

An active command leads to trip shutdown with the error code "Process fault" or creates an alarm message. The reaction time is adjustable. Errors in the system can be integrated in the inverter controls using this input. The trip message can be realized by means of break or make contacts (selected using E3.14 to E3.17).
The digital input is also active in bus control mode.



Reset position

This input sets the value of position, which can be read out via the PZD Bus channel, to zero.
Make contact: Position value is hold on zero.
Break contact: Position value is running according to the counted pulses of encoder.



DMA enable

This input enables a controlled change-over between speed control and DMA control (Slave mode).
Break contact: speed control operation
Make contact (or input not used): DMA control active
The digital input is also active in bus control mode.

1.) Each function can only be selected once. **"Double assignments are not possible!"**
2.) The outputs of the comparator/logic modules (parameters F4.xx) can also be linked with these functions.
3.) These functions can be also used for B6 "Bit x - Control word".
4.) If a digital input is to perform 2 functions, this is possible via the comparator/logic modules.
5.) Inversion of a digital input is also possible via the comparator/logic modules.

D2.00	DI1 selection	VICB	not used (see Macro)
D2.01	DI2 selection	VICB	not used (see Macro)
D2.02	DI3 selection	VICB	not used (see Macro)
D2.03	DI4 selection	VICB	not used (see Macro)
D2.04	DI6 2 selection	VICB	not used (see Macro)
D2.05	DI7 2 selection	VICB	not used (see Macro)
D2.06	DI8 2 selection	VICB	not used (see Macro)
D2.07	DI5 3 selection	VICB	not used
D2.08	DI6 3 selection	VICB	not used
D2.09	DI7 3 selection	VICB	not used
D2.10	DI8 3 selection	VICB	not used

0 .... not used •
1 .... Start FWD
2 .... Start REV
3 .... Start FWD impulse
4 .... Start REV impulse
5 .... Stop impulse
6 .... +speed remote
7 .... -speed remote
8 .... Start impulse local
9 .... Stop impulse local
10 .. REV local make contact = REV in local mode
11 .. +speed local
12 .. -speed local
13 .. Jog
14 .. Pre-set A
15 .. Pre-set B
16 .. Pre-set C
17 .. Manual (Auto) make contact = f-ref Manual
18 .. Local (Remote) make contact = local control (E4.00 to 03)
19 .. 2.ramp make contact = accel./decel. ramp 2 selected
20 .. User Macro 2 make contact = user macro 2
21 .. Enable break contact = lock - free wheel
22 .. External fault parametrize additionally E3.11 to E3.13
23 .. External motor fault parametrize additionally E2.13 to E2.15
24 .. Insulation fault parametrize additionally E3.18 to E3.20
25 .. External BS-fault parametrize additionally E3.09 to E3.10
26 .. External Reset
27 .. External T-limitation make contact = external torque limitation active
28 .. PID active make contact = PID controller active
29 .. PID enable make contact = PID controller output enabled
30 .. Speed control active make contact = speed control active
31 .. Brake open make contact = brake open
32 .. Supply ON/OFF
33 .. ON lock break contact = switch-off with "ON lock"
34 .. Force local
35 .. Parameter locked in addition to F6.00
36 .. FWD (REV) for BUS active only !
37 .. Operation with IR
38 .. Motor heating ATTENTION: The motor data B3 must be set correctly !
39 .. Process fault parametrize additionally E3.14 to E3.17
40 .. Reset Position see Bus manual
41 .. DMA enable make contact = DMA control active
...
49 .. reserved for D2.02 only !
50 .. Emergency operation see function "Emergency operation" in chapter F6 (for D2.02 only)
51 .. reserved for D2.02 only !

D3 Analog outputs

D3.00	AO1 selection	VCB	not used (see Macro)

0 ... not used •
1 ... Output frequency 100 % = fMAX (C3.01)
2 ... |Output frequency| 100 % = fMAX (C3.01)
3 ... Output current 100 % = Nom. motor current (B3.01)
4 ... Torque 100 % = Nom. motor torque (B3.00, B3.04)
5 ... |Torque| 100 % = Nom. motor torque (B3.00, B3.04)
6 ... Power 100 % = Nom. motor power (B3.00)
7 ... Motor voltage 100 % = nominal motor voltage (B3.02)
8 ... Speed 100 % = fMAX in rpm (C3.01 x 60 / 2p)
9 ... |Speed| 100 % = fMAX in rpm (C3.01 x 60 / 2p)
10 . int. f-reference 100 % = fMAX (C3.01), after accel., before fs compensation
11 . int. T-reference 100 % = Nom. motor torque (B3.00, B3.04)
12 . PID reference value 100 % = 100 % (C4.00)
13 . PID feedback 100 % = 100 % (C4.01)
14 . PID error 100 % = 100 % (C4.02)
15 . Bus ref1 100 % = 4000 hex
16 . Bus ref2 100 % = 4000 hex
17 . Bus ref3 100 % = 4000 hex
18 . Bus ref4 100 % = 4000 hex
19 . Bus ref5 100 % = 4000 hex
20 . Thermal state Motor 100 % = max. allowed therm. motor loading (E2.04…E2.07)
21 . Thermal state BR 100 % = max. allowed therm. loading of braking resistor (E3.07 and E3.08)
22 . Test min. value corresponds to AO min. value 0 or 4 mA
23 . Test max. value corresponds to 20 mA

Multiple assignments are possible!
This means that an analog value can be assigned to more than one output.

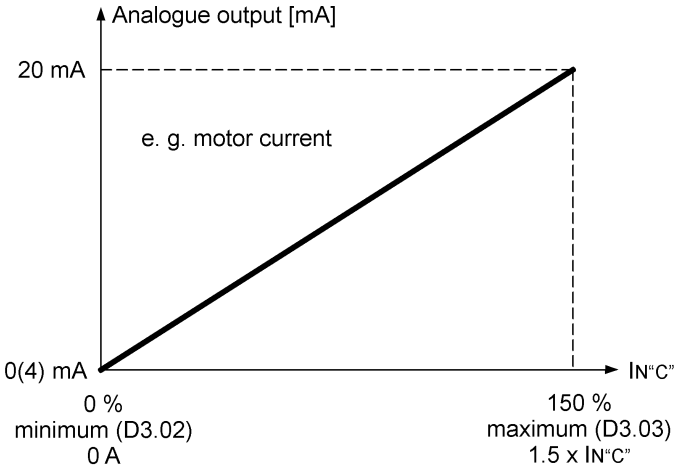
D3.01	AO1 level	VCB	4-20 mA

0 ... 0-20 mA
1 ... 4-20 mA •

D3.02	AO1 min. value	VCB	-200...***0***...200 %
D3.03	AO1 max. value	VCB	-200...***100***...200 %

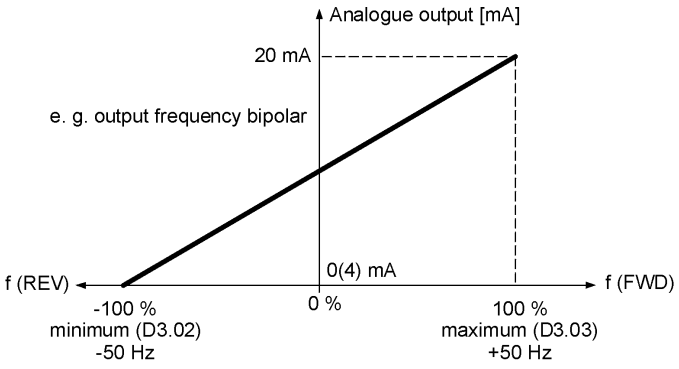
The analog output is configured using these parameters. The value selected for D3.00 (please note the relevant standardization) is available as 0(4)-20 mA signal for external display. The analog output is tuned using the parameters D3.02 = 0(4) mA and D3.03 = 20 mA.

Typical setting for:
2; 3; 5; 7; 9; 11;



100 % = IN =e. g. 210 A
minimum = 0(4) mA ≙ 0 % (0 % x IN)
maximum = 20 mA ≙ 150 % (150 % x IN)

Typical setting for:
1; 4; 6; 8; 10; 12-19



100 % = fMAX = e. g. 50 Hz
minimum = 0(4) mA ≙ -100 % (-50 Hz)
maximum = 20 mA ≙ 100 % (+50 Hz)

D3.04	AO2_2 selection	VCB	not used (see Macro)

Possible settings, see D3.00. Analog output for option card IO1 at slot X2.

D3.05	AO2_2 level	VCB	4-20 mA

Possible settings, see D3.01.

D3.06	AO2_2 min. value	VCB	-200...***0***...200 %
D3.07	AO2_2 max. value	VCB	-200...***100***... 200 %

Possible settings, see D3.02 and D3.03.

D3.08	AO2_3 selection	VCB	not used

Possible settings, see D3.00. Analog output for option card IO1 at slot X3.

D3.09	AO2_3 level	VCB	4-20 mA

Possible settings, see D3.01.

D3.10	AO2_3 min. value	VCB	-200...***0***...200 %
D3.11	AO2_3 max. value	VCB	-200...***100***... 200 %

Possible settings, see D3.02 and D3.03.

D4 — Logic outputs

Available digital outputs:
- 1 x 24 V voltage output, max. 150 mA
- 1 x relay output ""change-over"
- 2 x relay output ""change-over" (Option Card IO1 in Slot X2)
- 2 x relay output "make contact" (Option Card IO1 in Slot X3)

The following states can be assigned to all digital outputs:

State	Relay picks up...
Ready	... if there is no trip and the drive is not running. if the control voltage is applied with activated mains contactor control C6.00.
Run	... on accepted Start command or guided deceleration.
Trip	... on trip, until confirmed.
Ready and Run	... if a ready or run state exists.
Alarms	... during a programmed warning situation (see Appendix A).
Bus alarm	... while bus communication is interrupted.
Generator operation	... if the motor is in generator state.
Line ON	... on switch-over to Line ON state with activated contactor control C6.00.
Local operation	... as long as the drive is in LOCAL mode.
f(n)=fREF	... if the frequency act. value corresponds to the reference value (D4.08). if speed control is activated, the actual speed is compared.
f>fLEVEL	... if f > "f-Level ON" D4.06, and drops off again when f < "f-Level OFF" D4.07.
Lift brake	... if the mechanical braking unit is to be lifted (crane function C6.01 to C6.10).
Output C1	... if conditions in comparator block C1 are met (F4.00 to F4.07).
Output C2	... if conditions in comparator block C2 are met (F4.08 to F4.15).
Output C3	... if conditions in comparator block C3 are met (F4.16 to F4.29).
Output C4	... if conditions in comparator block C4 are met (F4.30 to F4.43).
Output L5	... if conditions in logic module L5 are met (F4.44 to F4.49).
Output L6	... if conditions in logic module L6 are met (F4.50 to F4.55).
Thyristor-ON	... if charging of the DC link is completed. (for control of an external charging connection or feedback unit)
BUS Control w. 11	... if the free bit 11 in the bus control word is 1.
BUS Control w.12	... if the free bit 12 in the bus control word is 1.
BUS Control w.13	... if the free bit 13 in the bus control word is 1.
BUS Control w.14	... if the free bit 14 in the bus control word is 1.
BUS Control w.15	... if the free bit 15 in the bus control word is 1.
ON (+24V)	... as soon as control voltage is available (+24V interrogation voltage for digital inputs).
Manual operation	... if the drive is in manual mode (D1, D2).
2.Param.set active	... on switch-over to parameter set 2 using a digital input (B2.04).
Ext.T-limit. active	... if an external torque limitation is activated (E1.01).
PID active	... if the PID controller is active (C4.04).
PID enabled	... if the output of the PID controller is active (C4).
Speed ctrl. active	... if the speed control is active (D5.02).
Trip inverted	... if there is no trip (= drive is ready for operation).
Limit I >	... if the current limitation is active *) or the heatsink temperature is too high.
Limit V >	... if the voltage limitation is active. *)
Limit Temp. >	... if the motor protection (thermal motor state) is active.
Limitations	... if one of the limitations above is active.
Alarm 1	... during a programmed warning situation (see Appendix A).
Alarm 2	... during a programmed warning situation (see Appendix A).
BU active	... if the braking unit is switched on (minimum time 1,5 seconds).
Motor heat. active	... if the function "Motor heating" is active.

*) The message for this limitation is currently not in function !

D4.00	+24 Digital Output	VC	ON (24 V)
D4.01	Relay output 1	VCB	Ready + Run (see Macro)
D4.02	Relay output 2_2	VCB	not used (see Macro)
D4.03	Relay output 3_2	VCB	not used (see Macro)
D4.04	Relay output 2_3	VCB	not used
D4.05	Relay output 3_3	VCB	not used

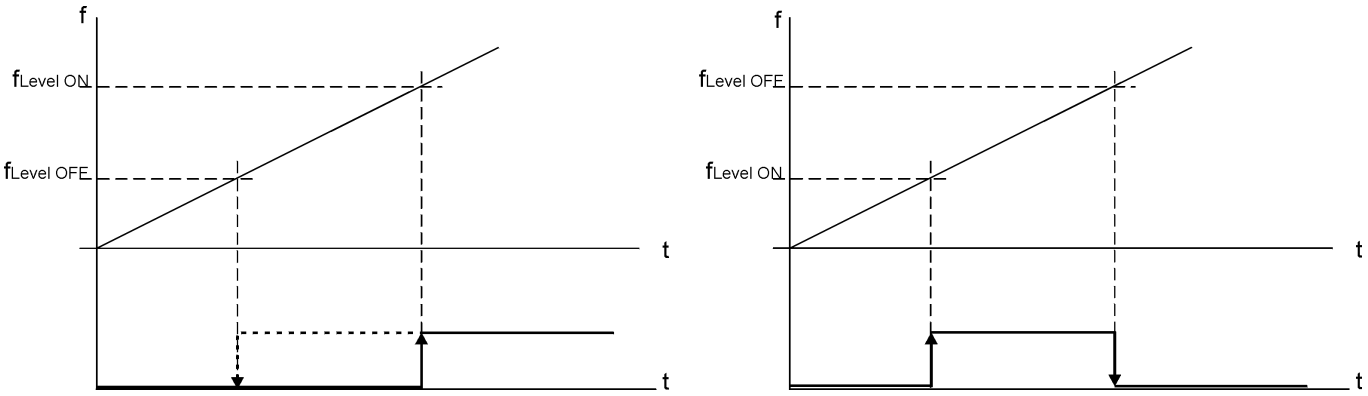
0 ... not used •
1 ... Ready
2 ... RUN
3 ... Trip
4 ... Ready and Run
5 ... Alarms
6 ... Bus alarm
7 ... Generator operation
8 ... Line ON
9 ... Local operation
10 . f(n) = fREF
11 . f>fLevel
12 . Lift brake
13 . Output Comparator C1
14 . Output Comparator C2
15 . Output Comparator C3
16 . Output Comparator C4
17 . Output Logic L5
18 . Output Logic L6
19 . Thyristor ON
20 . BUS Control Word 11
21 . BUS Control Word 12
22 . BUS Control Word 13
23 . BUS Control Word 14
24 . BUS Control Word 15
25 . ON (24 V) •
26 . Manual operation
27 . 2. Parameterset active
28 . External T-limitation active
29 . PID active
30 . PID enabled
31 . Speed control active
32 . Trip inverted
33 . Limit I> current limitation active *) or heatsink temp. >
34 . Limit V> voltage limitation active *)
35 . Limit Temperature > motor protection (thermal motor model) active
36 . Limitations sum message for all limitations
37 . Alarm 1 see alarm messages (Appendix A)
38 . Alarm 2 see alarm messages (Appendix A)
39 . BU active
40 . Motor heating active

*) The message for this limitation is currently not in function !

Multiple assignments are possible!
I.e., more than one relay output can indicate the same state!

D4.06	f-Level ON	VCB	0.00...***5.01***...300.00 Hz
D4.07	f-Level OFF	VCB	0.00...***2.01***...300.00 Hz

The limits for the digital signal ">fLevel" are set using these two parameters.



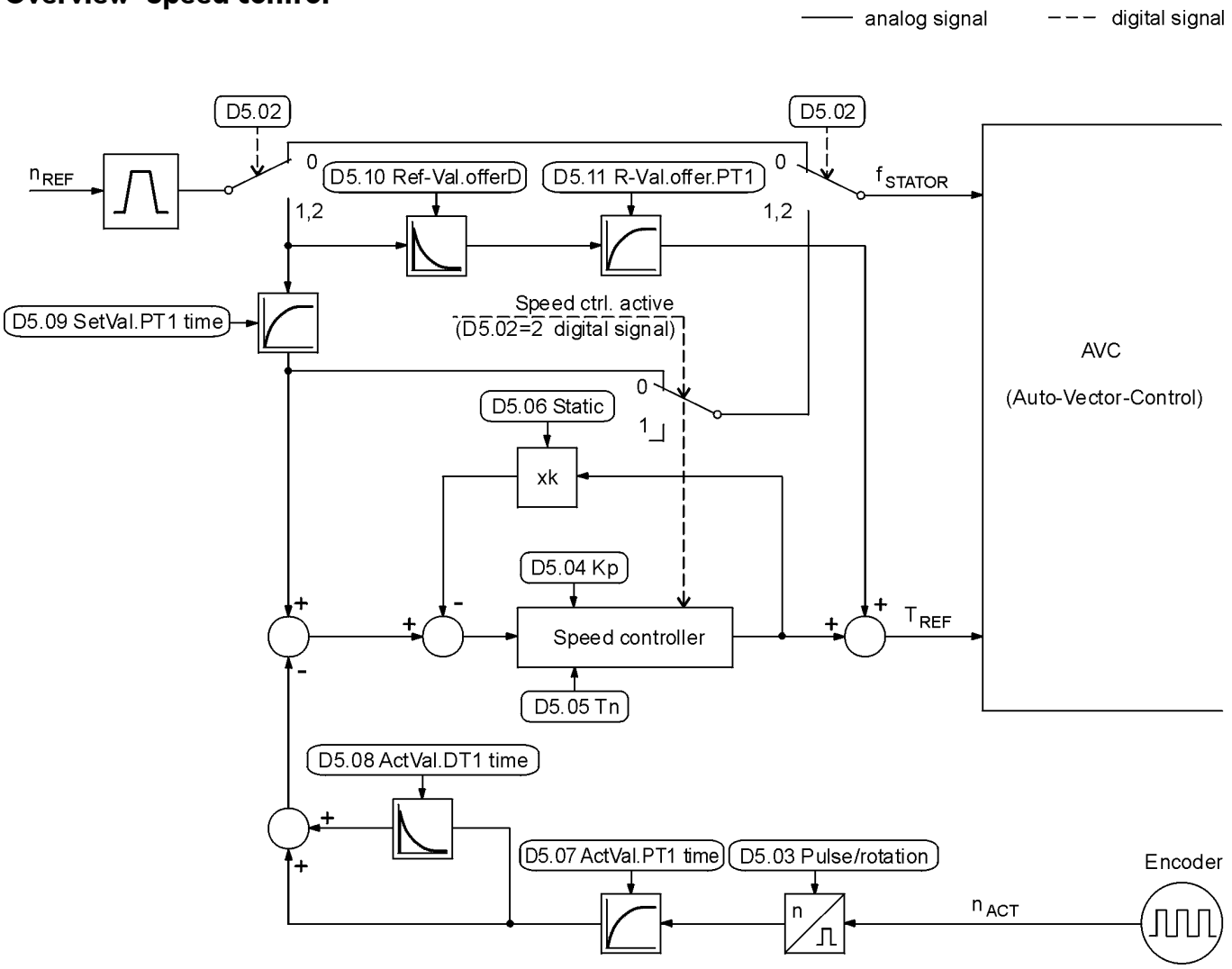
D4.08	Hysteresis f=fref	VCB	0.1...***0.5***...10.0 Hz

Hysteresis for the digital signal f = fREF is set using this parameter. At the same time, the filter time for the signal is prolonged.

e.g. 0.5 Hz means ± 0.5 Hz hysteresis and 0.5 sec. delay time

The signal f = fREF is available at the relay outputs, the bus state word, the comparator interrogation, and in the status bar of the display.

Overview "Speed control"



D5.00	Encoder / Slip compensation	VICB	No encoder

0 ... No encoder• standard applications (AVC mode works with calculated speed values)

1 ... Slip compensation precise speed (automatic slip compensation without encoder)

2 ... Encoder applications with encoder (AVC mode works with measured speed values)

3 ... Load balance see parameter D5.12

In position "0", the speed display is calculated from the actual frequency and the current slip compensation ("Sensorless Vector Control").
In position "1", the calculated slip frequency is added to the frequency reference value and the load-dependent revving down of the asynchronous motor is thus compensated. This produces a high static speed precision. The dynamics of this control circuit can be adjusted in rough increments using parameter D5.01 "Dynamic of slip compensation".
In position "2", the measured speed signal is available for all displays and protection functions. Using the speed signal increases the pitch stability of the drive in the lowest speed range.
For the function "Catch on the fly" of the motor the measured speed signal is used.

D5.01	Dynamic of slip compensation	VCB	low

0 ... low •
1 ... medium
2 ... high

This parameter is only active if D5.00 is set to "1 Slip compensation" or "3 Load balance".

D5.02	Speed control active	VICB	not active

0 ... not active •
1 ... active
2 ... depending on DI
3 ... as DMA Slave see parameters D5.13...16
4 ... DMA Slave DI

In position "0 not active", the actual speed is used for all speed displays and monitors (frequency control).
In position "1 active", the speed control is activated.
Position "2 depending on DI" switches over from speed control to frequency control depending on a digital input.

This parameter is only active if D5.00 is set to "2 Encoder".

D5.03	Pulse / rotation	VICB	-10000...+***1024***...+10000 pulse/r

Value for impulses per rotation depending on the encoder used. Please note the information in the Mounting Instructions, Chapter "SFB Option" with regard to selection of the encoder. Basically, encoders with impulse values over 30 can be used. However, for speed control encoders with a higher pulse value per rotation (typ. 1024 pulses/rotation) are recommended.
A plus or minus sign of the pulse value adjusts the direction of motor rotation to the direction of rotation of the encoder (crossing of signals A and B between encoder and SFB not required).

CAUTION: An incorrect setting for D5.03 can compromise the safety of the unit!

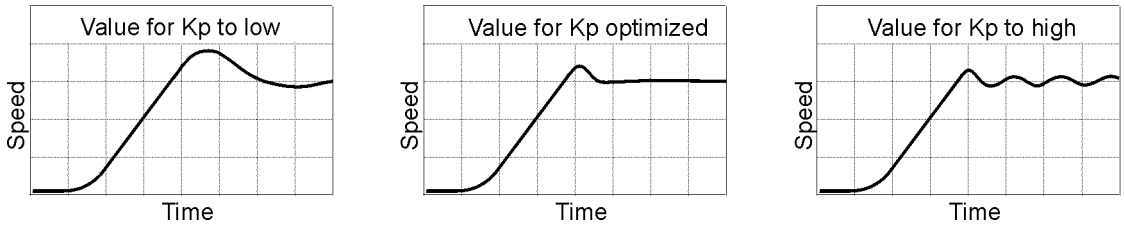
D5.04	Speed controller kp	VCB	0.0...***0.0***...200.0

For balance-weight dominated drives, a typical setting value can be calculated using the formula:

$$kp = \frac{t_{ACCEL.}\,(\text{accel. time of drive with nominal torque}) \quad [s]}{2 \cdot D5.07}$$

Acceleration time:

$$t_{ACCEL.} = \frac{\sum J \cdot n_N}{9.55 \cdot T_N}$$

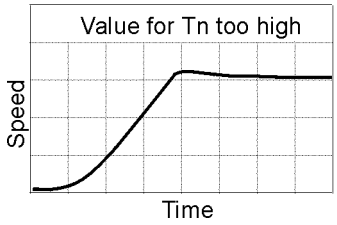


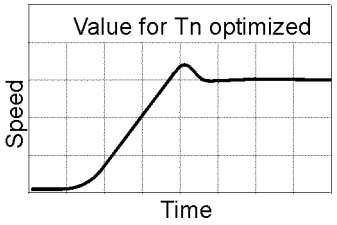
The acceleration time is measured correctly without a load torque; i.e. for hoists, for example, without a load on the hook.

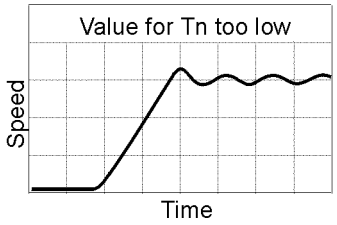
D5.05	Speed controller Tn	VCB	0.00...***0.00***...10.00 s

For drives with a high balance weight, a typical setting can be calculated using the formula:

$$T_N = 4 \cdot D5.07$$







D5.06	Speed controller static	VCB	0.0...***0.0***...20.0 %

By setting a static value, the controller output is locked onto the input negatively. This produces a soft control. (However, the setting leads to static deviation from the ref. value.)

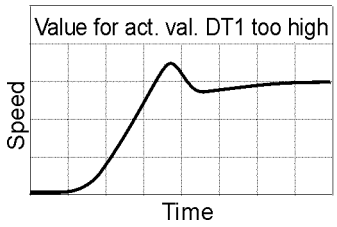
D5.07	Actual value PT1 time	VCB	0.00...***0.00***...10.00 s

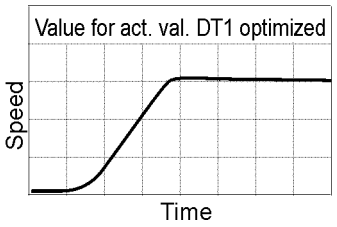
This parameter defines the dynamic of the speed control.

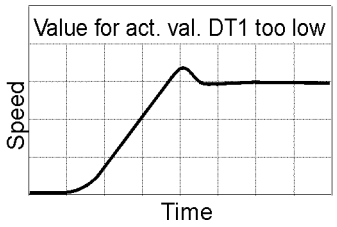
Very high dynamic:	0.02s	(impulse values > 200 recommended)
High dynamic:	0.10s	
Medium dynamic:	0.20s	(impulse values over 30 possible)

D5.08	Actual value DT1 time	VCB	0.00...***0.00***...1.00 s

The setting for D5.08 improves the speed control's reaction to disturbances.

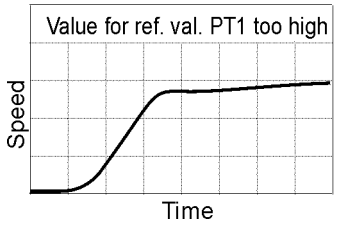


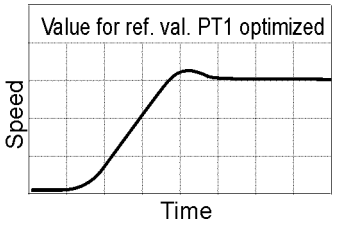


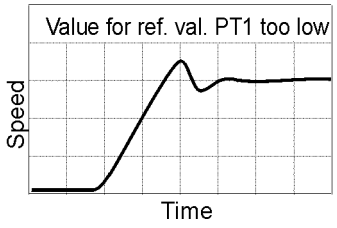


D5.09	Set value PT1 time	VCB	0.00...***0.00***...10.00 s

Filter for ref. value channel.







D5.10	Reference value offer. D	VCB	0.0...***0.0***...10.0

A D-share in the ref. value pick-up increases the dynamic in case of changes in ref. value.

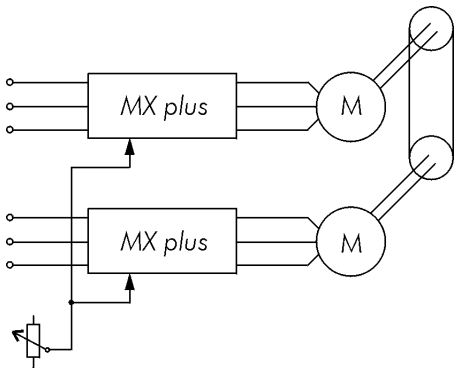
D5.11	Reference value offer. PT1	VCB	0.00...***0.00***...1.00 s

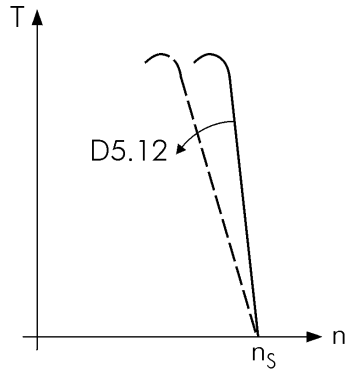
Filter for ref. value pick-up.

D5.12	Load balance	VCB	0.00...***0.00***...10.00 Hz

At applications with two or more inverters (without encoder feedback) parallel for one load, the load balance is based on the motor slip.
With this parameter the slip is additionally increased and different motor data can be matched. The value sets the frequency decrease at nominal torque. With parameter D5.01 the dynamic can be influenced.

This parameter is only active if D5.00 is set to "1 Slip compensation" or "3 Load balance".





In case of load > 100% of the nominal motor torque the compensation keeps constant.

D5.13	DMA T-controller	VCB	0.000...***0.040***...1.000 s

Parameter to adjust the time constant of the DMA function.

D5.14	DMA K-controller	VCB	0.000...***0.010***...0.200

Parameter to adjust the amplification of the DMA function.
With parameters D5.13 and D5.14 the function "DMA torque balance" can be adjusted correctly.

D5.15	DMA T-Master	—	read only

The parameter displays the actual torque of the DMA Master.

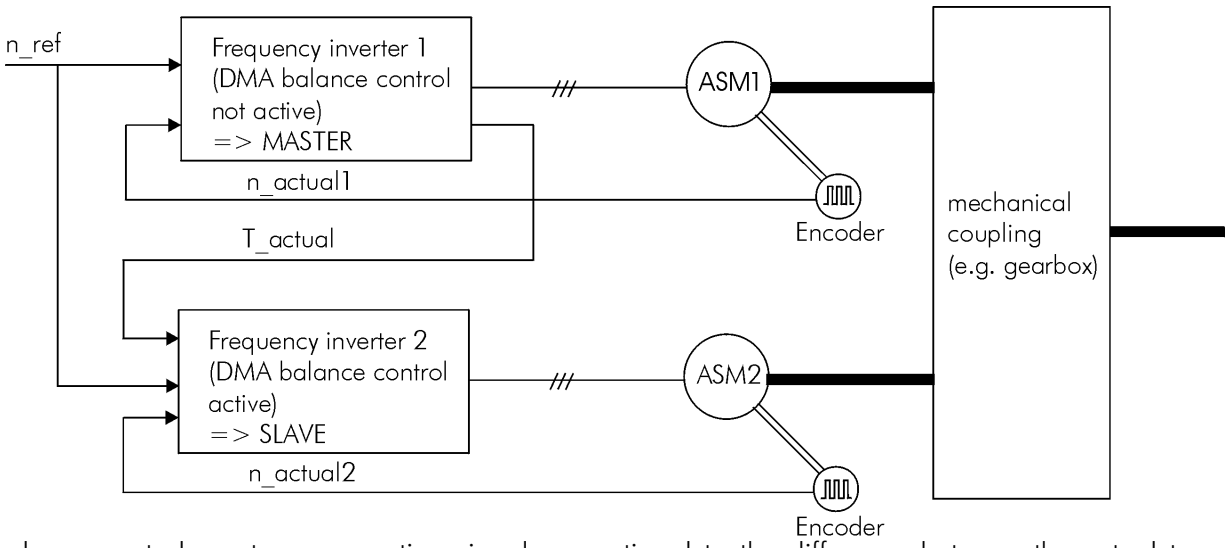
D5.16	DMA f-correction	—	read only

Displays the compensation of frequency (32-times value)

This function provides the possibility to operate two speed-controlled drives with mechanical coupling. If no special methods are applied, this operating mode leads to interacting tension of the drives (that means that the drives run up to the motoric or generatoric current limit after some time) because of the I-rate of the speed controller and unavoidable inexactness.

By adjusting the parameter D5.02 to setting "3 as DMA-Slave" the function to balance the torque is activated.

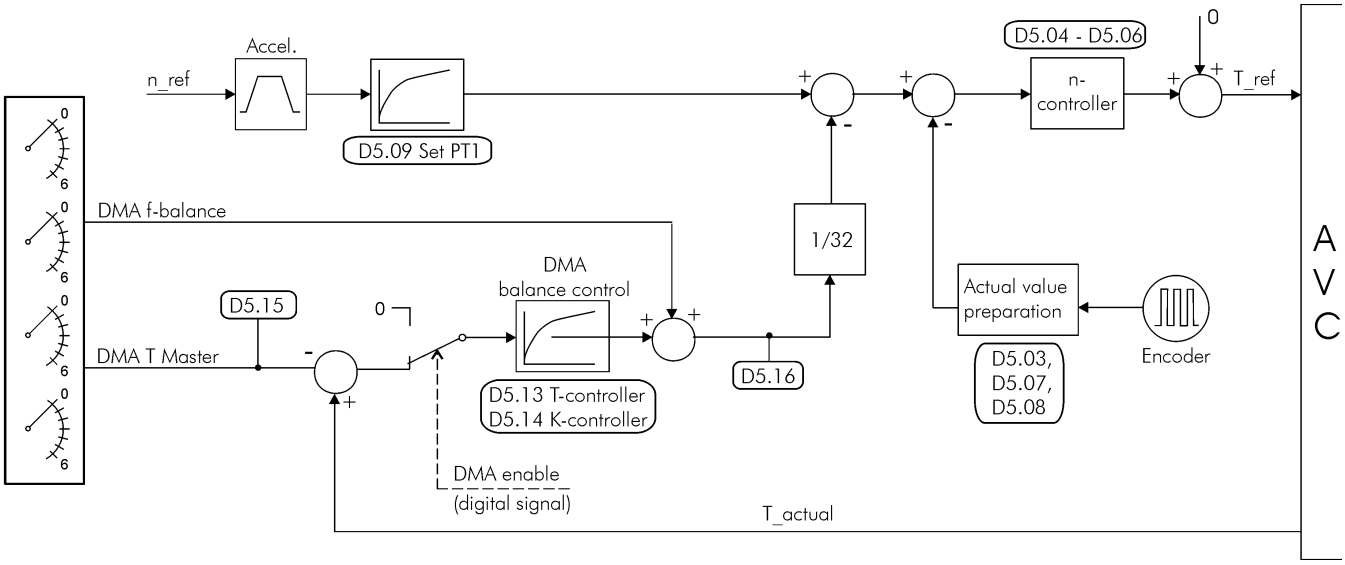
In position "2 DMA Slave DI" the function is released depending on a digital signal at the terminals, the bus or as an output of a logic module.



The balance control creates a correction signal proportional to the difference between the actual torques of Master and Slave. This signal influences the speed reference value. Therefore, the actual torque of the Master must be available for the Slave, which is carried out to minimize the delay time via analog terminal signals. The subtraction of the correction signal from the internal speed reference value happens after the run-up integrator and filter of the reference value.

If the function DMA-Slave is active, the parameters D5.10 and D5.11 are not active !

One more possibility is to supply the correction signal external (bus or terminals - "DMA f-balance") or to add it to the internal value. Therewith an external balance control or an external position-controller can be realized, for example.
Note: 100% (or 1.0) correspond to 163.84Hz/32=5.12Hz, that means 307.2 rotations/min for a 2pole machine at the shaft.



Remarks for practice

For successful use of the DMA function, please observe:

- Motor and mechanics of both drives have to be similar (different motors and moment of inertia are possible, in principle, but then a precise analysis and specific knowledge of the mechanics is necessary)
- Start Autotuning for both Master and Slaves
- Similar adjustment of the parameters for the speed controller D5.04...D5.11 of Master and Slave.
  More information about the settings for the speed controller is given at parameter D5.04.
  The moment of inertia must be parametrized to the half of the whole mechanical inertia (two motors are in parallel !)
  e.g. $J_{total} \approx 22\ kgm^2$, $T_N = 1950$ Nm, $n_N = 1000$ r/min, D5.07 is set to 10ms

$$\rightarrow D5.04 = \frac{22/2 \cdot 1000}{9{,}55 \cdot 1950} \cdot \frac{1}{2 \cdot 10^{-3}} \cong 30$$

  $D5.05 = 4 \cdot D5.07 = 40$ ms

- Set the analog output of the Master:
  - AOx-selection: set to "4...Torque"
  - AOx-level: set according to the adjustment on the analog input of the slave
  - AOx-min. value: -150%
  - AOx-max. value: +150%
- Set the analog input of the Slave:
  - AIC (AI_x) - selection: set to "8...DMA T Master"
  - AIC (AI_x) - level: see AOx
  - AIC (AI_x) - value 0%: -150%
  - AIC (AI_x) - value 100%: +150%
  - AIC (AI_x) - filter time: should be set to 0 s to avoid negative influences to the dynamic of the balance control; the analog connection must be "well screened" because interferences may reduce the quality of the speed control.
- Both frequency inverters have to receive their identical reference values **synchronous**. If the reference values are send via Profibus, both inverter must operate in "Sync Mode" (see parameters B6.49, B6.55 and B6.64 in the manual "Option Profibus PBO1").
- Set the acceleration and deceleration ramps of both inverter to 0 s or at least to the same values
- Adjustment of the balance controller (parameter D5.13 and D5.14)
  Recommended values:
  D5.13 (T-controller) = D5.05 (n-controller Tn)
  D5.14 (K-controller) = 1/D5.04 (n-controller Kp)
  e.g.: D5.05 = 40 ms → D5.13 = 40ms
  e.g.: D5.04 = 30 → D5.14 = 0,033
  This values lead to very good dynamic results, decreasing the values for the K-controller and increasing the time constant of the T-controller are uncritical.
  With D5.14 = 0 the balance control is not active !
- Parameters D5.10 and D5.11 are without function !
- Both drives must have an encoder and the corresponding pulse rate must be set with D5.03. Adjust D5.00 to setting "2 Encoder", set D5.02 to "1 active" for the Master and to "3 as DMA Slave" for the Slave.
- Limitations of the MX like "Catch on the fly", acceleration and deceleration at the current and voltage limits a.s.o. work at double drives without restrictions.

Parameter settings depending on required performance

	D5.00	D5.01	D5.02	D5.03	D5.04...11
"Frequency control" Standard drives (AVC without encoder)	0	X	X	X	X
"Slip compensation" High static speed precision (AVC without encoder)	1	0...2	X	X	X
"Encoder mode" High torque precision as well as pitch stability at 0 Hz and perfect crane overload protection, full torque control (AVC with encoder)	2	X	0	pulse value	X
"Speed control mode" Maximum speed precision static and dynamic, (AVC with encoder)	2	X	1 or 2	pulse value	make settings

(x ... any setting for parameter)

Speed and torque precision, torque control time

Operating mode	Frequency control	Slip compensation	Encoder mode 1.)	Speed control 1.)
Ref. resolution analog Ref. precision analog	10 bit =0.1% of max. reference value ±0.6% AIV; ±0.9% AIC; ±1.1% AI2_2 and AI2_3			
Ref. resolution digital	0.01 Hz			
Speed precision at n > 10 % at n < 5 % in field suppression range	 f_{SLIP} f_{SLIP} $f_{MAX} / f_N * f_{SLIP}$	 0.3 f_{SLIP} 0.5 f_{SLIP} $f_{MAX} / f_N * f_{SLIP} / 3$	 f_{SLIP} f_{SLIP} $f_{MAX} / f_N * f_{SLIP}$	 ± 0.01% of C3.01 ± 0.01% of C3.01 ± 0.01% of C3.01
Torque precision at f > f_{SLIP} at 0 Hz in field suppression range	 ± 5% of T_N — ± 5% of T_N	 ± 5% of T_N — ± 5% of T_N	 ± 5% of T_N ± 5% of T_N ± 5% of T_N	 ± 5% of T_N ± 5% of T_N ± 5% of T_N
Torque control time	approx. 2 ms	approx. 2 ms	approx. 2 ms	approx. 2 ms

1.) As is common in dynamic drives, the max. output voltage reaches only 92...95%. Therefore, it is recommended that the motor is designed for this reduced nominal voltage.
In order to avoid the interfering influence of limitation actions, one or more restrictions should be observed in speed control mode with nominal speed:
- Extend acceleration ramp
- Set current limitation < 150%
- Set D5.07 ≥ 0.04s

D6 Electronic Potentiometer

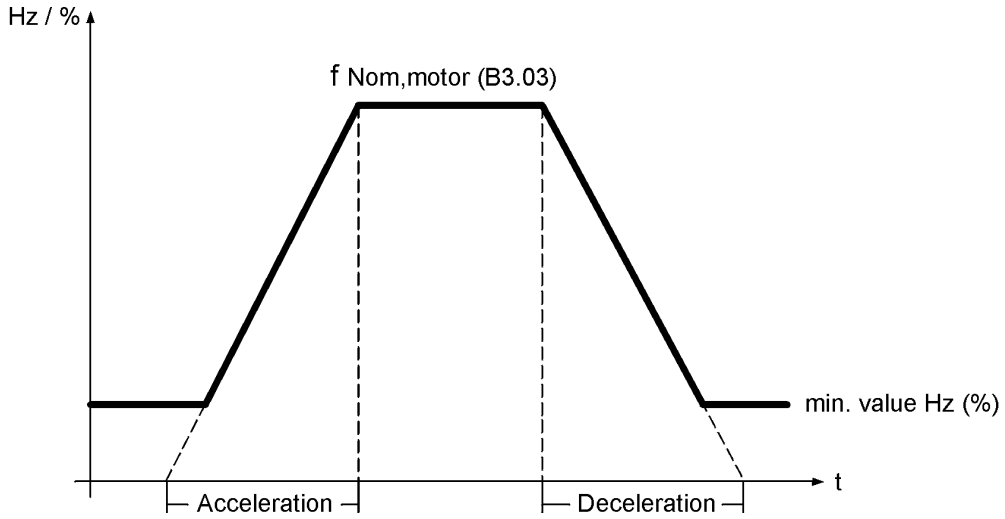
Basically, there is a distinction between the LOCAL motor potentiometer on the keypad and the REMOTE motor potentiometer at the terminal strip.

D6.00	Local MP selection	VICB	frequency reference

0 ... frequency reference • Hz
1 ... torque reference %

The local motor potentiometer can be used as a source for the frequency ref. value or as ref. value for torque limitation. Depending on the use, the scale unit is changed automatically (f-ref in Hz, T-ref in %).

D6.01	Local MP min. value	VCB	0.00...***0.00***...300.00 Hz 0.00...***0.00***...200.00 %
D6.02	Local MP max. value	VCB	0.00...***50.00***...300.00 Hz 0.00...***30.52***...200.00 %
D6.03	Local MP acceleration time	VCB	0.0...***10.0***...3200.0 s
D6.04	Local MP deceleration time	VCB	0.0...***10.0***...3200.0 s



The motor potentiometer (MP) accel. and decel. time is the time (s) required by the motor potentiometer to change the frequency ref. value from 0 Hz to B3.03 $f_{NOM,MOTOR}$ (with setting D6.00 = 1 - 0...100 % T_N) is defined.

The resolution (step by pressing the key) depends on the adjusted acceleration and deceleration time.
e.g.: 10 s → step of 0.5 Hz
20 s → step of 0.25 Hz

D6.05	Local ref. storage	VCB	not active

0 ... not active •
1 ... at Mains-off and Stop
2 ... at Stop

If "reference-storage" is set to "2...at Stop", the set reference value is stored after a Stop command, but reseted after mains disconnection.
If "1...at Mains-off" is selected, the drive goes to the stored ref. value again when a new Start command is issued and also after a mains disconnection.

D6.06	Remote MP selection	VICB	not used

0 .... not used •
1 .... f-ref Manual Hz
2 .... f-ref Auto • Hz
3 .... f-correction Hz
4 .... T-limitation %
5 .... PID reference %

If individual settings cannot be selected, they have already been assigned by one of the other reference value sources or by a bus reference value!

The remote motor potentiometer is used as the source for various ref. value defaults. A function is assigned to the motor potentiometer using parameter D6.06. For control, 2 digital inputs must be set to the functions "+speed remote" and "-speed remote" (D2.00 – D2.10). The remote motor potentiometer can be used as a source for the frequency ref. value, the correction ref. value, the torque limitation ref. value or the PID ref. value. The scale unit is changed automatically, depending on the use (f-ref, f-correction in Hz / T-ref, PID-ref. value in %).

With pulse inhibit, only the function "-speed remote" is enabled!

D6.07	Remote MP min. value	VCB	-300.00...***0.01***...+300.00 Hz -200.00...***0.01***...200.00 %
D6.08	Remote MP max. value	VCB	-300.00...***50.01***...+300.00 Hz -200.00...***30.52***...200.00 %
D6.09	Remote MP acceleration time	VCB	0.0...***10.0***...3200.0 s
D6.10	Remote MP deceleration time	VCB	0.0...***10.0***...3200.0 s

Same function as D6.03 / D6.04.
See figure "Configuration of Analog Inputs", D1.

D6.11	Remote MP control	VCB	terminals

0 ... keypad
1 ... terminals •

By switching over to "0 keypad", the required motorpot value is defined using the up/down keys on the keypad. If PID-controller function is used, an external ref. value setting is not necessary. Required ref. value adjustments can be made directly on the device at any time.

D6.12	Remote ref. storage	VCB	not active

0 ... not active •
1 ... at Mains-off and Stop
2 ... at Stop

Same function as D6.05.

E1 — Drive overload

E1.00	Current max. value	VCB	10...***150***...150 % (see Macro)

This parameter defines the maximum current overload capacity in percent of the inverter current version C (high overload). At maximum heatsink temperature, 150% of the nominal unit current is available for 1 min in 10 min in the frequency range > 10 Hz. As soon as the time is elapsed, the current is reduced to 120 % $I_{N"C"}$ (at 2.5 kHz) without shutdown, in order to protect the inverter. If the maximum value (E1.00) is set to less than 120 % $I_{N"C"}$, there is no further time limitation for the load current.
→ Power reduction depending on switching frequency, see Mounting Instructions!

E1.01	Torque max. value	VCB	10...***200***...200 %

This parameter limits the motor torque. The setting 100% corresponds to the nominal motor torque. If exceeded, the frequency is reduced.
If an analog input (terminal strip or bus) is set to "4 torque limitation", this function takes over the torque limitation. In addition, it is possible to switch over between the two limitation standards using a digital input. If the digital input (or comparator output) is parametrized for the function "26 Ext. T-limitation" and High (contact made), the unit switches over to external T-limitation.

	Analog input	
Digital input	not selected	selected
not selected	TLIM=parameter E1.01	TLIM =analog signal
selected and = 0	TLIM =parameter E1.01	TLIM =parameter E1.01
selected and = 1	TLIM =parameter E1.01	TLIM =analog signal

At low speed (≤ 2 Hz), accurate torque adjustment is not possible when working without an encoder!

E2 — Motor protection

E2.00	Thermistor input Activation	VCB	not active

0 ... not active • No thermistor input used.
1 ... always active Thermistor is connected and errors are reported.
2 ... Ready / Run An error is reported only during Ready and Run state.
3 ... Run An error is reported only during Run state.

For more information about the resistor specifications, see Mounting Instructions.

E2.01	Thermistor input Response	VCB	Trip

0 ... Trip •
1 ... Alarm 1
2 ... Alarm 2

Motor temperature monitoring using thermistors can be evaluated as a trip or as an alarm. Unlike the trip message, alarm does not lead to shutdown of the inverter. The digital output must be parametrized for "Alarms" and the information must be processed externally.

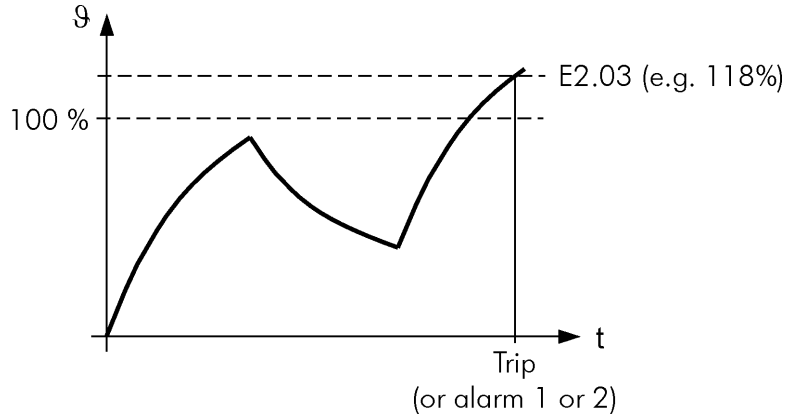
E2.02	Motor overload Response	VCB	Current limitation

0 ... Current limitation • An overload of the motor leads into current limitation.
1 ... Trip An overload of the motor leads into trip.
2 ... Alarm 1 An overload of the motor is displayed as alarm message
3 ... Alarm 2 "Overload Motor". Additionally, this signal can be used for a relay output (D4.00...D4.05).

This parameter defines the behavior of the drive at overload of the motor, which is calculated via the thermal model of the motor (parameters E2.04…E2.07).

E2.03	Level motor overload	VCB	0..***118***...200 %

This parameter defines the trigger level for trip or alarm. The value is related to I^2 depending on the adjusted current/speed characteristic.



The trigger level is only active, if parameter E2.02 is set to "1...Trip", "2...Alarm 1" or "3...Alarm 2" !

E2.04	I max at 0 Hz	VCB	5..***31***...150 % (see Macro) 1.
E2.05	I max at f nom	VCB	30...***100***...150 % (see Macro) 1.

100% correspond to nominal motor current (see B3.01).

E2.06	Therm. f-limit	VCB	0...***30***...300 Hz 1.

E2.07	Motor time constant (τ)	VCB	1...***5***...3200 min 1.

The motor-time constant τ describes the heat accumulation response of the motor. The steady-state temperature is reached within approx. 4...5 time constants at nominal operation (I_N and f_N). The default setting for the time constant of 5 min is very low in order to maintain sufficient motor protection even in the case of repeated mains shutdown. If required, the precise value can be found out from the motor supplier, and guideline values are shown in the following table (reset to factory default using parameter F2.01 "Return fact. motor").

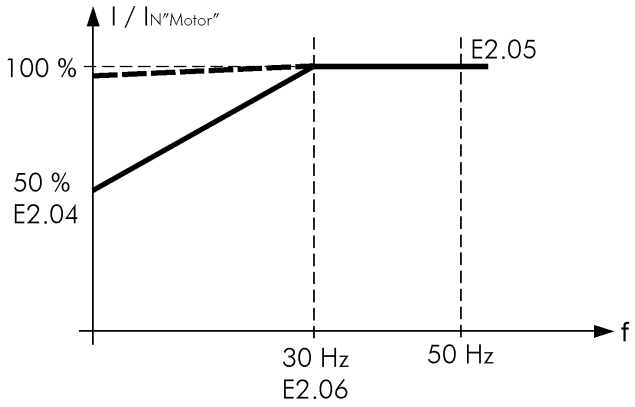
1. Motor protection - thermal motor model with current limitation function

Unlike the overload limitation (parameter E1.00), which provides an overload protection for the inverter, the thermal motor model calculates the temperature rise in the motor based on the maximum steady currents at the nominal operating point and at the speed zero, taking into account the thermal time response and the respective speed (cooling conditions).

Parameter E2.02 is set to "0...current limitation"

In case of overload, the motor current is reduced to the set DC curve (E2.04...E2.06). This leads to a speed reduction, leading to a stable operating point in case of loads with a square load torque (e.g. pumps and fans). If this does not succeed, e.g. in constant moment drives, the output frequency is reduced to 0 Hz. If this state persists for longer than the stalling time set with parameter E2.08 (with a frequency lower than the set stalling frequency E2.09), the result is a trip with the message "Motor overload".

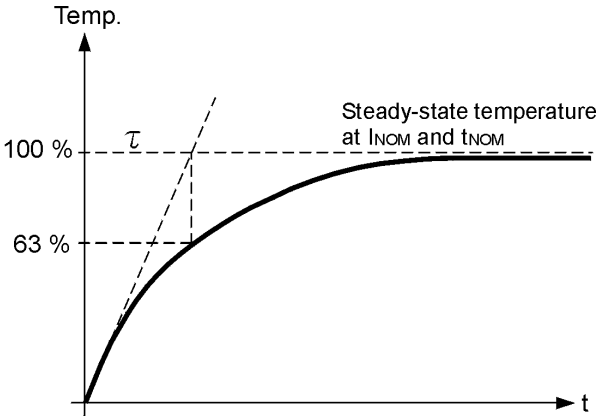
Current/speed characteristics



Reduced cooling in self-ventilated motors !!

Number of poles	Motor capacity		
	160 - 200	225 - 280	315 - 400
2, 4-pole	45 min	50 min	60 min
6, 8-pole	60 min	80 min	100 min

Thermal characteristics of the motor

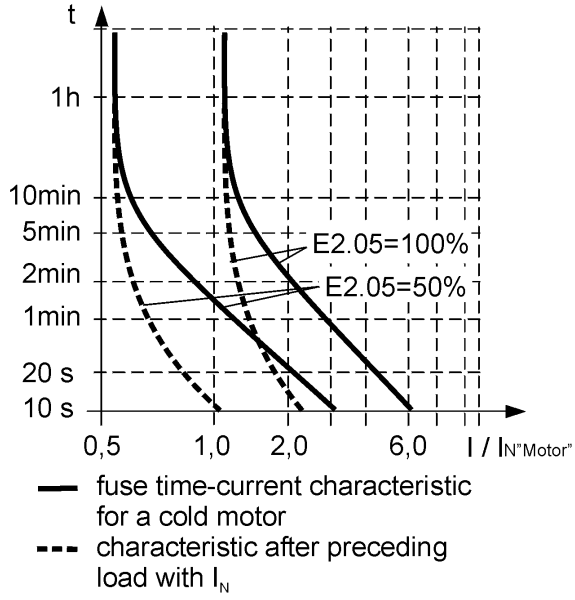


The actual thermal state of the motor can be displayed with parameters A2.12, A6.00...A6.02, an analog output or B6.11, B6.13, B6.15, B6.17 and B6.19. The thermal state can be also used for the function blocks F4.

2. UL motor protection

By setting parameter B3.05 "Line voltage" to "460 V; 50/60 Hz", the motor protection model (cable protection) is activated in accordance with UL approbation. As a result, the thermal motor model E2.02...04, E2.06 and E2.07 has no function.

The overload-time monitor depends on E2.05 and thus functions with reference to the nominal motor current. If the current-time area is exceeded, the result is a trip with the message "(60) Motor Overload".



The electronic motor protection is reset to a "cold motor" by switching off the mains supply.

If the setting for parameter E2.07 is increased, it is imperative that the inverter is supplied using a fail-safe 24V buffer voltage via the terminals P24 and P0V.

E2.08	Stalling time	VCB	0...***60***...160 s
E2.09	Stalling frequency	VCB	0...***5***...20 Hz
E2.10	Stalling current	VCB	0...***80***...150 %

100% corresponds to nominal motor current (see B3.01).
A blocked or highly overloaded motor during start-up is identified if it is operated at an output frequency lower than the stalling frequency, with a current greater than the stalling current, and for a time longer than the stalling time. The inverter is switched off with the trip message "Stall protection".

E2.11	n>> protection	VCB	Trip

0 ... not active
1 ... Trip • Trip of the drive with message "Overspeed".
2 ... Alarm 1 Alarm message "Overspeed"; can be additionally used for
3 ... Alarm 2 a relay output (D4.00...D4.05).

The overspeed protection can be evaluated both as a trip and as a warning. The motor speed is also monitored in pulse inhibit state (message in case of actively driving load states).
The warning has a release hysteresis of 100 rpm.

E2.12	n max motor	VCB	200...***3200***...18000 rpm

Maximum speed in rotations per minute. The default setting of 3200 rpm allows the operation of a 2-pole motor up to 50 Hz. For other pole numbers of a higher output frequency, the value must be changed accordingly !

E2.13	Ext. Motor fault Activation	VCB	not active

0 ... not active •
1 ... N.O. active
2 ... N.O. Ready + Run
3 ... N.O. Run
4 ... N.C. active
5 ... N.C. Ready + Run
6 ... N.C. Run

The parameter defines the inverter's reaction when "Braking resistor overload" is triggered.

A digital input (D2.00...D2.10) must be set to "23...Ext. motor fault" for this function !

E2.14	Ext. Motor fault Response	VCB	Trip

0 ... Trip • Trip of the drive with message "Motor trip".
1 ... Alarm 1 Alarm message "Ext. Motor fault"; can be additionally used for
2 ... Alarm 2 a relay output (D4.00...D4.05).

E2.15	Ext. Motor fault time delay	VCB	0.0...***1.0***...160.0 s

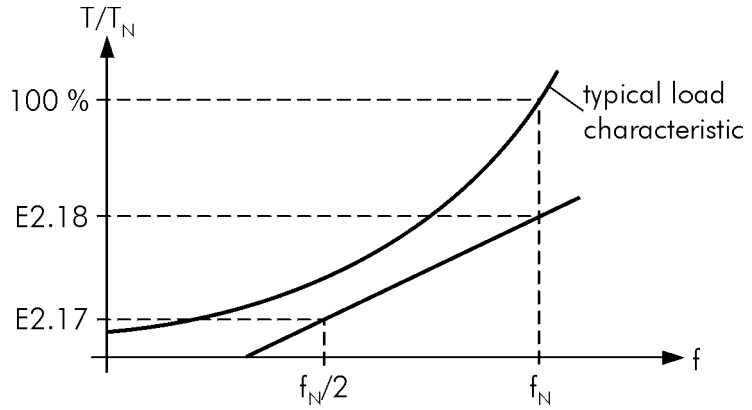
The safety shutdown "Motor trip" is only triggered if the signal "Ext. motor fault" is HIGH for longer than the set time.

E2.16	Underload Response	VCB	not active

0 ... not active •
1 ... T < Trip
2 ... T < Alarm 2
3 ... PID > Trip
4 ... PID > Alarm 2

E2.17	Underload f-nom/2	VCB	0...***15***...200 %
E2.18	Underload f-nom	VCB	0...***55***...200 %

This function allows a monitoring of the drive with respect to "Underload". Thus, the belt of a fan or the capacity of a pump can be controlled, for example



The monitoring of the torque can be parametrized as an alarm message or as a trip.

E2.19	Underload PID Error	VCB	-200...***50***...200 %

Alternatively to the monitoring of the torque, also the PID deviation C4.02 can be monitored by using the PID Process controller. Therefore, this parameter defines the allowed deviation.

E2.20	Underload Start time	VCB	0.0...***10.0***...3200.0 s

This parameter defines the start delay time of the underload monitoring after each Start-command.

E2.21	Underload Filter time	VCB	0.0...***3.0***...160.0 s

Use this parameter to set the filter time of the underload monitoring to avoid a triggering at short load fluctuations.

E3 — Fault configuration

E3.00	Autorestart	VCB	not active

0 ... not active •
1 ... active

If Autorestart is activated, the inverter tries to restart with an automatic reset after a trip.
This process is repeated 3x within 5 min, before final shutdown.

If a Start command and Auto-Restart are active in the case of a "transient" error, there is an automatic restart!

List of trips which cannot be reset immediately and which are not influenced by the auto-restart function:

(38)	BU (Braking Unit) fault	(60)	Motor overload
(49)	Overtemperature 1 inverter	(61)	Stall protection
(51)	Undervoltage 1	(65)	Charge protection
(52)	Undervoltage 2	(67)	Braking resistor overload

E3.01	Local Reset	VCB	active

0 ... not active
1 ... active •

This parameter defines whether an error can be confirmed with the key "O/Stop/Reset" on the keypad. By default, the local confirmation option is activated.

E3.02	Reaction at trip	VCB	Free wheel (OFF 2)

0 ... Free wheel (OFF 2) •	Pulse inhibit immediately and free run-down of the motor.
1 ... Decel. ramp (OFF 1)	Deceleration according ramp and trip at 0 Hz.
2 ... Fast-stop (OFF 3)	Fast-stop (with motor brake or braking unit, if used) and trip message at 0 Hz.

This parameter defines the behavior of the inverter in case of a trip.
If setting "1...Deceleration ramp" or "2...Fast-stop" is selected, the function is executed in case of following trips:

(50)	Bus Comm. 2	(59)	Thermistor Short-circuit
(54)	Ext. fault	(60)	Motor overload
(55)	Ext. Motor fault	(64)	External BS (braking unit) fault
(56)	Insulation fault	(67)	Braking Resistor overload
(57)	4 mA fault	(69)	Process fault
(58)	Motor Temperature > (Thermistor)	(70)	Underload Motor

E3.03	Loss of 4 mA Activation	VCB	not active

0 ... not active •	
1 ... always active	Even unused analog inputs are monitored with the setting "4...20 mA monitored" !
2 ... Ready + Run	
3 ... at Run	

Analog reference values can be monitored for values below 3mA with the setting "4...20 mA monitored". Depending on the setting, monitoring is provided either in Ready and Run state or in Run state only.

E3.04	Loss of 4 mA Response	VCB	Trip

0 ... Trip •	An input signal ≤ 3 mA leads into trip with "4mA fault".
1 ... Last f + Alarm 1 *2 ... Last f + Alarm 2*	The operation continues with the last speed (before loss of the analog signal) until the signal is > 3 mA or a Stop- or Pulse lock command is given. At restart the drive runs up to minimum frequency (C3.00), if the analog signal is ≤ 3 mA.
3 ... Fixed f + Alarm 1 *4 ... Fixed f + Alarm 2*	The operation continues with the frequency set with parameter E3.05 until the signal is ≥ 3 mA or a Stop- or Pulse lock command is given.

The alarm command is indicated on the display and can be additionally send as a signal via a relay output (D4.00...D4.05). The backspacing is done delayed (3 s).

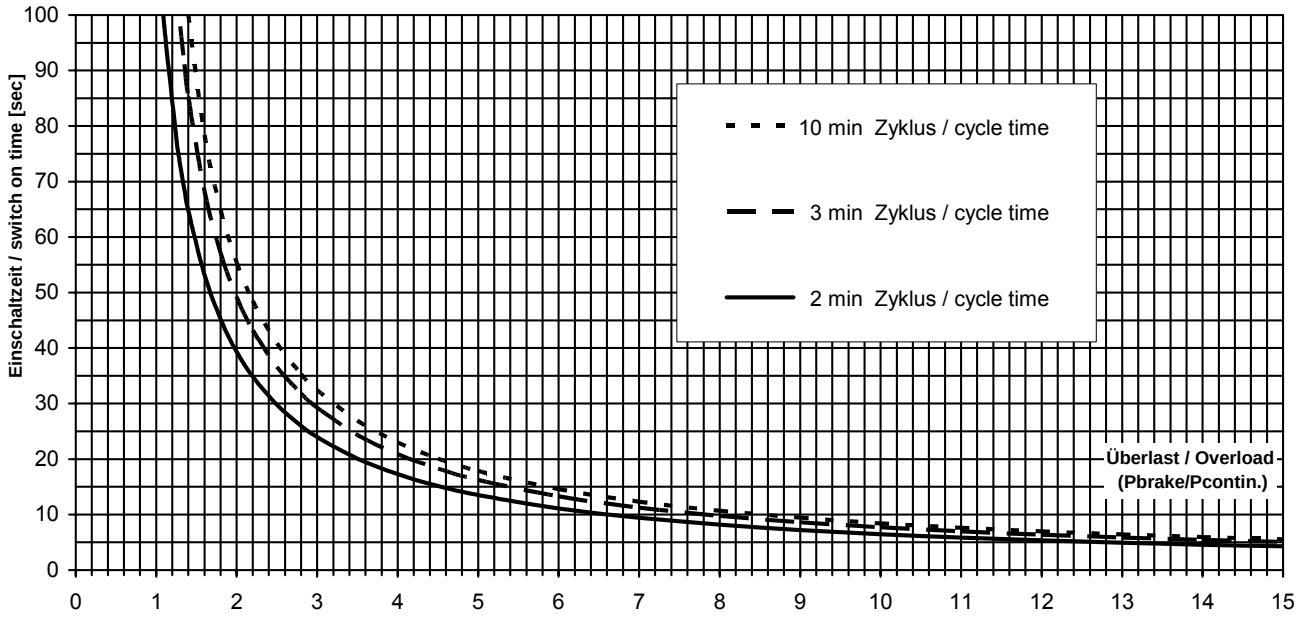
E3.05	Loss of 4 mA fixed frequency	VCB	-300.00...***+10.00***...+300.00 Hz

Adjustment of the frequency, which is used from the inverter as reference, if the monitored analog input fails.

E3.06	BR overload Response	VCB	not active

0 ... not active •
1 ... Trip Trip of the drive.
2 ... Alarm 1 Alarm message, can be additionally send as a signal via
3 ... Alarm 2 a relay output (D4.00...D4.05).
REMARK: Depending on the local regulations an external protection of the braking unit could be necessary or the inverter has to be supplied with an additional control supply of 24V DC (after a switch-off of supply, the Thermal state of BR always starts with cold state).

The parameter defines the inverter's reaction when "Braking resistor overload" is triggered.
The switch-on time of the braking resistor is monitored according to the characteristics, depending on the overload factor (braking power related to continuous power) and the cycle time.



E3.07	BR continuous power	VCB	0.1...***1.0***...1000.0 kW

This parameter is set corresponding to the used braking resistor (sum of continuous power, if the resistors are parallel or serial !).

E3.08	BR Ohm value	VCB	0.1...***10.0***...200.0 Ohm

This parameter is set corresponding to the used braking resistor (if several resistors are parallel or serial, the total resistance must be adjusted !).

E3.09	Ext. BS fault Activation	VCB	N.O. Ready + Run

0 ... not active
1 ... N.O. active
2 ... N.O. Ready + Run •
3 ... N.O. Run
4 ... N.C. active
5 ... N.C. Ready + Run
6 ... N.C. Run

Input for switching off the device in the event of a defect in the external braking unit, with the display "Ext. BS fault".

The function will be active after "Mains ON" !

A digital input (D2.00...D2.10) must be set to "25...Ext. BS fault" for this function !

E3.10	Ext. BS fault time delay	VCB	0.0...***5.0***...160.0 s

Start delay time (after Mains-ON) for "Ext. BS fault".

E3.11	External fault Activation	VCB	not active (see Macro)

0 ... not active •
1 ... N.O. active
2 ... N.O. Ready + Run
3 ... N.O. Run
4 ... N.C. active
5 ... N.C. Ready + Run
6 ... N.C. Run

Trips registered by the device (e.g. overpressure, ...) can be integrated as an external fault using a break (N.C.) or make contact (N.O.). If "Ready + Run" is selected, monitoring is performed in Ready or Run state, if "Run" is selected, it is performed only in Run mode.

A digital input (D2.00...D2.10) must be set to "22...Ext. fault" for this function !

E3.12	External fault Response	VCB	Trip

0 .... Trip • Trip of the drive with message "Ext. fault".
1 .... Alarm 1 Alarm message "Ext. fault"; can be additionally used for
2 .... Alarm 2 a relay output (D4.00...D4.05).

E3.13	External fault time delay	VCB	0.0...***0.0***...160.0 s

The message "Ext. fault" is only issued if the signal is HIGH for longer than the set time (for N.C. contacts: LOW).

E3.14	Process fault Activation	VCB	not active

0 ... not active •
1 ... N.O. active
2 ... N.O. Ready + Run
3 ... N.O. Run additional delay time E3.16 possible
4 ... N.C. active
5 ... N.C. Ready + Run
6 ... N.C. Run additional delay time E3.16 possible

Trips registered by the device (e.g. overpressure, ...) can be integrated as an process fault using a break (N.C.) or make contact (N.O.). If "Ready + Run" is selected, monitoring is performed in Ready or Run state, if "Run" is selected, it is performed only in Run mode.

A digital input (D2.00...D2.10) must be set to "39.Process fault" for this function !

E3.15	Process fault Response	VCB	Trip

0 .... Trip • Trip of the drive with message "Process fault".
1 .... Alarm 1 Alarm message "Process fault"; can be additionally used for
2 .... Alarm 2 a relay output (D4.00...D4.05).

E3.16	Process fault t1 delay	VCB	0.0...***0.0***...3200.0 s

This parameter defines the start delay time (after a Start command) for the trip "Process fault" (only possible for position 3 or 6 of E3.14).

E3.17	Process fault t2 delay	VCB	0.0...***0.0***...160.0 s

The message "Process fault" is only issued if the signal is HIGH for longer than the set time (for N.C. contacts: LOW).

E3.18	Insulation fault Activation	VCB	not active

0 ... not active •
1 ... N.O. active
2 ... N.O. Ready + Run
3 ... N.O. Run
4 ... N.C. active
5 ... N.C. Ready + Run
6 ... N.C. Run

The input works the same way as "External fault", but "Insulation fault" is displayed on the monitor and in the fault memory. It is used specifically for integration of ground contact monitoring in non-grounded mains.

E3.19	Insulation fault Response	VCB	Trip

0 .... Trip • Trip of the drive with message "Insulation fault".
1 .... Alarm 1 Alarm message "Insulation fault"; can be additionally used
2 .... Alarm 2 for a relay output (D4.00...D4.05).

E3.20	Insulation fault time delay	VCB	0.0...***10.0***...160.0 s

The message "Insulation fault" is only issued if the signal is HIGH for longer than the set time (for N.C. contacts: LOW).

E3.21	Undervoltage Response	VCB	not active

0 .... not active •
1 .... Trip at Run
2 .... Alarm 1
3 .... Alarm 2

By default, an undervoltage is not stored as a fault; i.e. on return and with an active Start command the drive continues to run automatically.
If the parameter is set to "1...Trip at Run", any undervoltage that persists for longer than the set time (E3.22) and occurs during operation of the device is treated as a fault "Undervoltage 1" and must be confirmed as soon as the voltage returns to normal. Used for drives that must not restart automatically (personal safety).

In case of parameter setting "2...Alarm 1" or "3...Alarm 2" the alarm message "Undervoltage 1" is displayed and a "General Alarm" will be generated.

If the crane function is active (hoist or traverse), the parameter will be set to "1 Trip at run" automatically.

E3.22	Undervoltage time delay	VCB	0.0...***2.0***...20.0 s

Setting of the permissible undervoltage time for automatic restart or for the trip message "Undervoltage 1" (if E3.21 is set to "1...Trip at Run", "2...Alarm 1" or "3...Alarm 2").

A setting > 2 s is only useful if the control electronics are permanently supplied with a 24 V buffer voltage !

If the crane function is active (hoist or traverse), the parameter will be set to 0s automatically.

E3.23	Inverter Temp. Response	VCB	I-limitation to 50 %

0 .... I-limitation to 50% •
1 .... I-limitation to 110%

To reach high availability, the inverter reduces the max. output current in case of too high heatsink temperature. Depending on the parameter setting, a trip of the drive occurs with the message "Overtemperature 1" at reduction to < 50 % or < 110 %.

If the crane function is active (hoist or traverse), the parameter will be set to "1 I-limitation to 110%" automatically.

An active current limitation is displayed as "Drive temp. >" at the display, on all relay outputs D4, on bus status word B6 and can be used for the function blocks F4.

E4 Control configuration

E4.00	Local/Remote reference	VICB	Local / Remote

0 ... Local / Remote • Ref. value from keypad or terminals (or bus).
1 ... Local only Ref. value from keypad (or terminal strip "Local functions") only.
2 ... Remote only Ref. value from terminal strip (or bus) only.

This parameter enables the possible sources for the frequency reference value:

LOCAL E4.03 = "0 keypad": The keys "Increase" / "Decrease" / "Reverse" / "Forward" are active.
E4.03 = "1 terminals": The digital inputs "+speed local" / "-speed local" and the function "REV local" are active.
REMOTE Frequency default via "f-ref MAN" or "f-ref Auto" or from PID-controller.
Possible ref. value sources: analog inputs AIV, AIC, AI_2, AI_3, pre-set ref. values, remote motorpot or one of the 5 bus ref. values.

E4.01	Local/Remote control	VICB	Local / Remote

0 ... Local / Remote • Control commands from keypad or terminals (or bus)
1 ... Local only Control commands from keypad (or terminal strip "Local functions") only
2 ... Remote only Control commands from terminal strip (or bus) only

This parameter enables the possible sources for the control commands:

LOCAL E4.03 = "0 keypad": The keys "I" / "O (Reset)" are active.
E4.03 = "1 terminals": The digital inputs "Start-I local" / "REV local" / "Stop-I local" are active.
REMOTE B6.01 = "0 terminals": The Start/Stop via the terminal strip "Start FWD" / "Start REV" and "Start FWD impulse" / "Start REV impulse" / "Stop impulse" are active.
B6.01 = "1 Bus": The Start/Stop commands of the bus control word (bits 0 to 10) are active.

The following options can be realized by combining the parameters "Loc./Rem. reference" and "Loc./Rem. control":

	Parameter setting E4.00 & 01		Switch-over
Operating mode	Loc./Rem. ref	Loc./Rem. control	Loc/Rem
Local and remote mode	Loc/Rem	Loc/Rem	active
f-ref. value reversible	Loc/Rem	Local only	active for f-ref.
f-ref. value reversible	Loc/Rem	Remote only	active for f-ref.
I/O commands reversible	Local only	Loc/Rem	active for I/O
I/O commands reversible	Remote only	Loc/Rem	active for I/O
Remote mode only	Remote only	Remote only	no effect
Local mode only	Local only	Local only	no effect
Mixed mode	Local only	Remote only	no effect *)
Mixed mode	Remote only	Local only	no effect *)

*) In these modes, the change in direction is assigned to the control source !!

E4.02	Local/Remote-switch	VICB	Keypad

0 ... Keypad •
1 ... terminals

If "Loc/Rem switch = terminals" is selected, the Loc/Rem key on the keypad is blocked.
A terminal strip command is used to switch over (see D2).

E4.03	Control mode local	VICB	Keypad

0 ... Keypad •
1 ... terminals

This parameter defines where the Start/Stop commands and the control commands for the local motor potentiometer are derived from in local mode - from the keys on the keypad or from the digital inputs "Start impulse local" / "Stop impulse local" / "REV local" / "+speed local" / "-speed local".

E4.04	Local STOP-key	VCB	Local active only

0 ... Local active only •
1 ... always active at local mode and control via terminals

If "Stop key always active" is selected, the STOP command can be issued using the STOP key on the keypad or the relevant digital input "Stop impulse local" in any mode. Depending on the setting for parameter C1.02 "Stop mode", the drive is stopped. With impulse contacts and BUS control, a renewed On command is required for acceleration. If the steady commands "Start FWD" or "Start REV" are applied to the terminal strip, the drive accelerates again immediately!!!

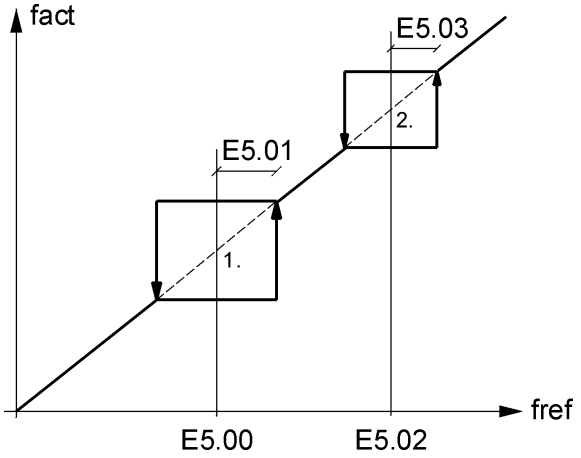
See setting example "Switching over to local control with local keys" in Chapter B5, "Short menu - Supplements to macros M1 to M4".

Pressing the Stop-key twice in case of local mode and pulse control via terminals causes pulse inhibit which leads to free wheel of the motor (and closes the brake at crane function).

E5 Skip frequency

E5.00	Skip frequency 1	VCB	5.00...***5.00***...300.00 Hz
E5.01	Hysteresis 1	VCB	0.00...***0.00***...4.00 Hz
E5.02	Skip frequency 2	VCB	5.00...***25.00***...300.00 Hz
E5.03	Hysteresis 2	VCB	0.00...***0.00***...4.00 Hz

The skip frequency defines the frequency at which the drive should not be operated in steady-state. The set hysteresis value defines the masked frequency range and acts symmetrically to the masking frequency.



If the frequency skip is activated, the limitation message "f-skip" is displayed.

The hysteresis of the skip frequencies **must not** overlap !

E6 Switching frequency

E6.00	Min. switching frequency	VCB	2.5 kHz

0 ... 2.5 kHz •
1 ... 5.0 kHz
2 ... 10.0 kHz (this setting is not possible for *MX basic & plus 315/400* and for *>pDRIVE< MX top*)

E6.01	Max. switching frequency	VCB	2.5 kHz

0 ... 2.5 kHz •
1 ... 5.0 kHz
2 ... 10.0 kHz (this setting is not possible for *MX basic & plus 315/400* and for *>pDRIVE< MX top*)

The inverter is equipped with a self-adjusting automatic pulse frequency.
Depending on the measured heatsink temperature, the switching frequency is set in such a way that the switching frequency is gradually reduced from the maximum value (E6.01) to the minimum value (E6.00) in the event of high load and simultaneous high cooler temperature. As a result, the device operates in an entirely fail-safe manner. The motor noise increases with decreasing switching frequency, however. The available switching frequency range can be limited or the automatic system can be switched off by using parameters E6.00 and E6.01. In order to keep the interference at the motor cable and the thermal load of the optional CE filters and AMFs as low as possible, the device is always operated with the minimum switching frequency at the factory default setting.

F1 Test-Help

F1.00	Test power part	VICB	Routine

0 ... Start • Start routine by changing to line 1 with the "Increase" key
1 ... Test Lower
2 ... Test Upper
3 ... No earth fault
4 ... Earth fault !!
5 ... Test not possible → no pulse enable!

The function "Test power part" is used to register ground contacts on the motor side of the frequency inverter. When the routine is activated, all 3 IGBTs of a half bridge on the motor side are activated for a short time. If an overload occurs during this phase, the message "Earth fault" is displayed. If the contactor control is activated, the contactor is addressed for the test time.

F1.01	Test control part	VICB	Routine

0 ... Start • Start routine by changing to line 1 with the "Increase" key
1 ... testing The control electronics carry out a software-hardware test and
2 ... fault ! then return to the initial screen.
3 ... no fault

The routine "Test control part" triggers a self-test of the inverter electronics with a subsequent boot function. During this time, data are transferred from the drive control to the user interface in devices with a loaded intermediate circuit. Data are also transferred from the user interface to the option card PBO1 (profibus connection).

F1.02 to F1.29
Parameters F1.02 to F1.29 contain descriptions and troubleshooting measures for the individual error messages. A list of the error messages can be found in the table in Appendix A.

F2 Factory setting

F2.00	Return factory application	VICB	Routine

0 ... Start • Start routine by changing to line 1 with the "Increase" key.
1 ... Return factory
2 ... O.K.

This routine resets the parameter settings (but not the motor data) to the factory default (Macro 1 "Conveyor") of the device, whereby all customer-specific entries are deleted!

The USER macros UM1 and UM2, the fault memory, the operating hours, the power on hours, the kWh meter, the language setting and "B3.05 Line voltage" are excepted from the reset with F2.00 and F2.01!

F2.01	Return factory motor	VICB	Routine

0 ... Start • Start routine by changing to line 1 with the "Increase" key.
1 ... Return factory
2 ... O.K.

This routine replaces all motor data with the factory default data. The customer-specific settings are deleted (B3.00 to 04 and B4.01 to 04 are reset).

If there is no mains voltage (e.g. active contactor control C6.00), the motor data and autotuning data are not reset !!

This routine has no influence on the motor data stored in the User Macros UM1 and UM2!

F3 Fault memory

F3.00	Fault code	—	read only
F3.01	Review	VB	0...***0***...15

F3 Fault memory

			last entry in memory			
F3.00	Fault code				15	1.)
F3.01	Review			2 Event -2	1 Event -1	0 newest event
F3.02	Trip number			13	14	15	
F3.03	Trip Message			61 Stall protect.	58 Mot.Temp.>	54 ext. trip	1.)
F3.04	Operating hours FI	(A5.01)		362,37 h	438,84 h	817,73 h	2.)
F3.05	Output frequency	(A3.00)		+0,6 Hz	+23,0 Hz	+43,4 Hz	2.)
F3.06	Speed	(A2.00)		+3 rpm	+649 rpm	+1260 rpm	2.)
F3.07	Motor current	(A2.03)		602 A	478 A	342 A	2.)
F3.08	DC-voltage	(A3.02)		533 V	541 V	545 V	2.)
F3.09	Heatsink temperature	(A3.03)		+25 °C	+71 °C	+63 °C	2.)
F3.10	Frequ. after ramp	(A4.12)		+50,0 Hz	+23,0 Hz	+43,4 Hz	2.)
F3.11	Operate-mode	(A1.02)		0 Remote	0 Remote	0 Remote	2.)
F3.12	Device status	(A3.11)		7 Run	7 Run	7 Run	2.)
F3.13	Drive control word	(A4.17)		047F hex	047F hex	047F hex	2.)3.)
F3.14	Drive status	(A1.03)		2 Acceleration	1 n=nref	1 n=nref	2.)
F3.15	Fault AR			0000 hex	0000 hex	0000 hex	2.) 3.)

1.) With every mains (or 24 V voltage) shutdown, an error message “+24V off” is entered. As long as parameter E3.21 “Undervoltage Response” is not set to “1 Trip”, the error message is overwritten every time. To do this the current number is set back by 1.

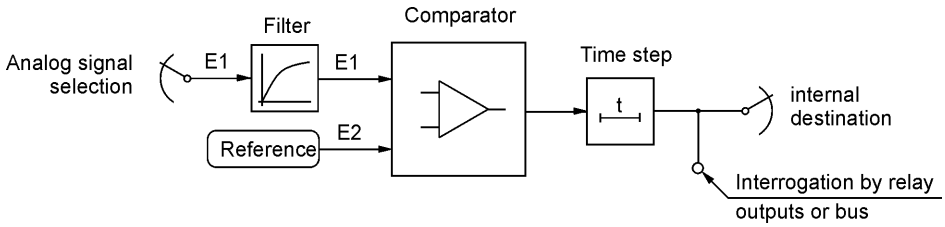
2.) All diagnostic values correspond to the actual values 10 msec before the trip.

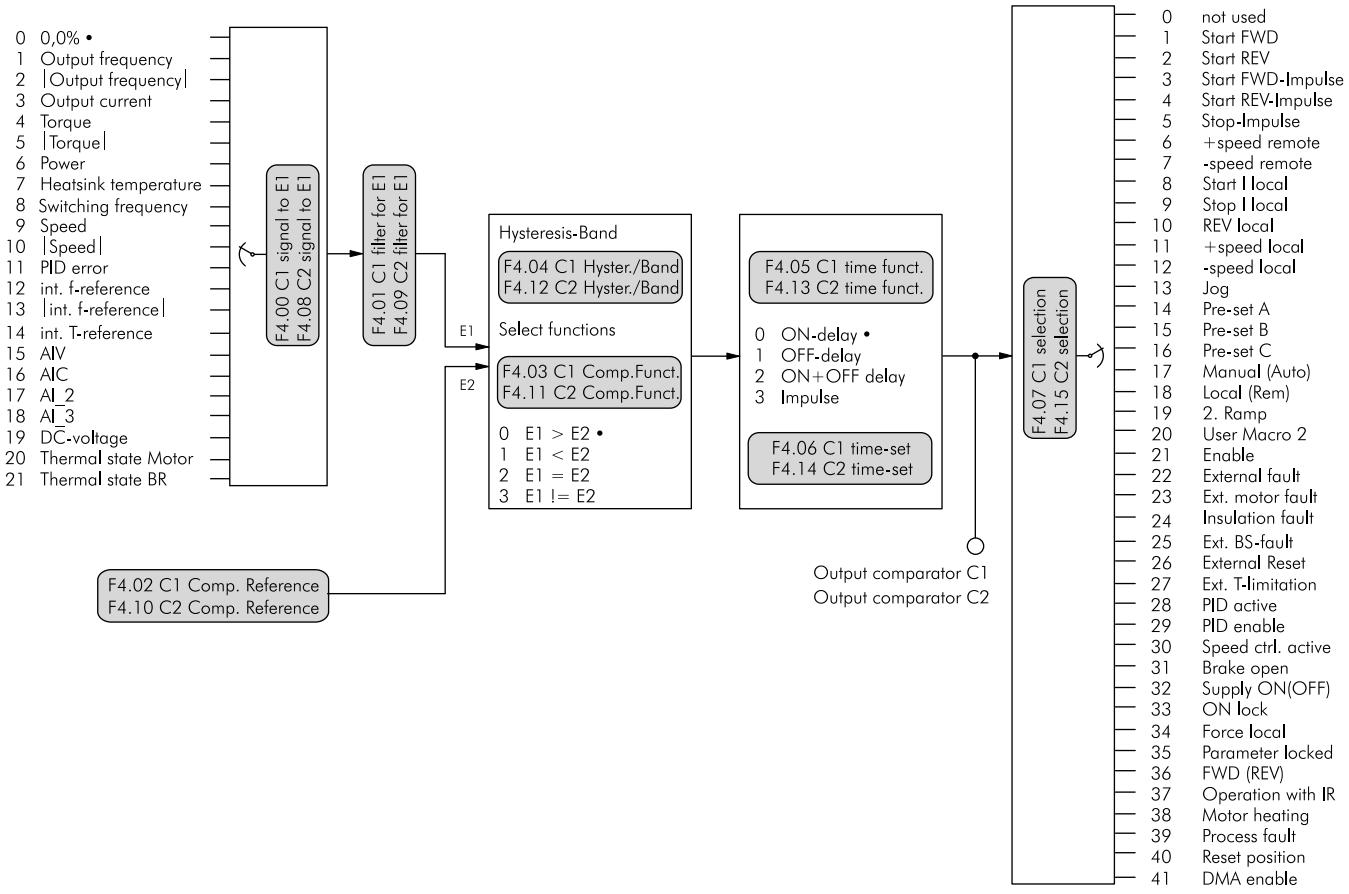
3.) Drive control word and error message(s) in hex code: see Manual “Option Profibus PBO1”, “Option Interbus GW-IBO1”, “Option CANopen GW-CBO1”, “Option DeviceNet GW-DBO1” and Service Manual.

F4 Function blocks

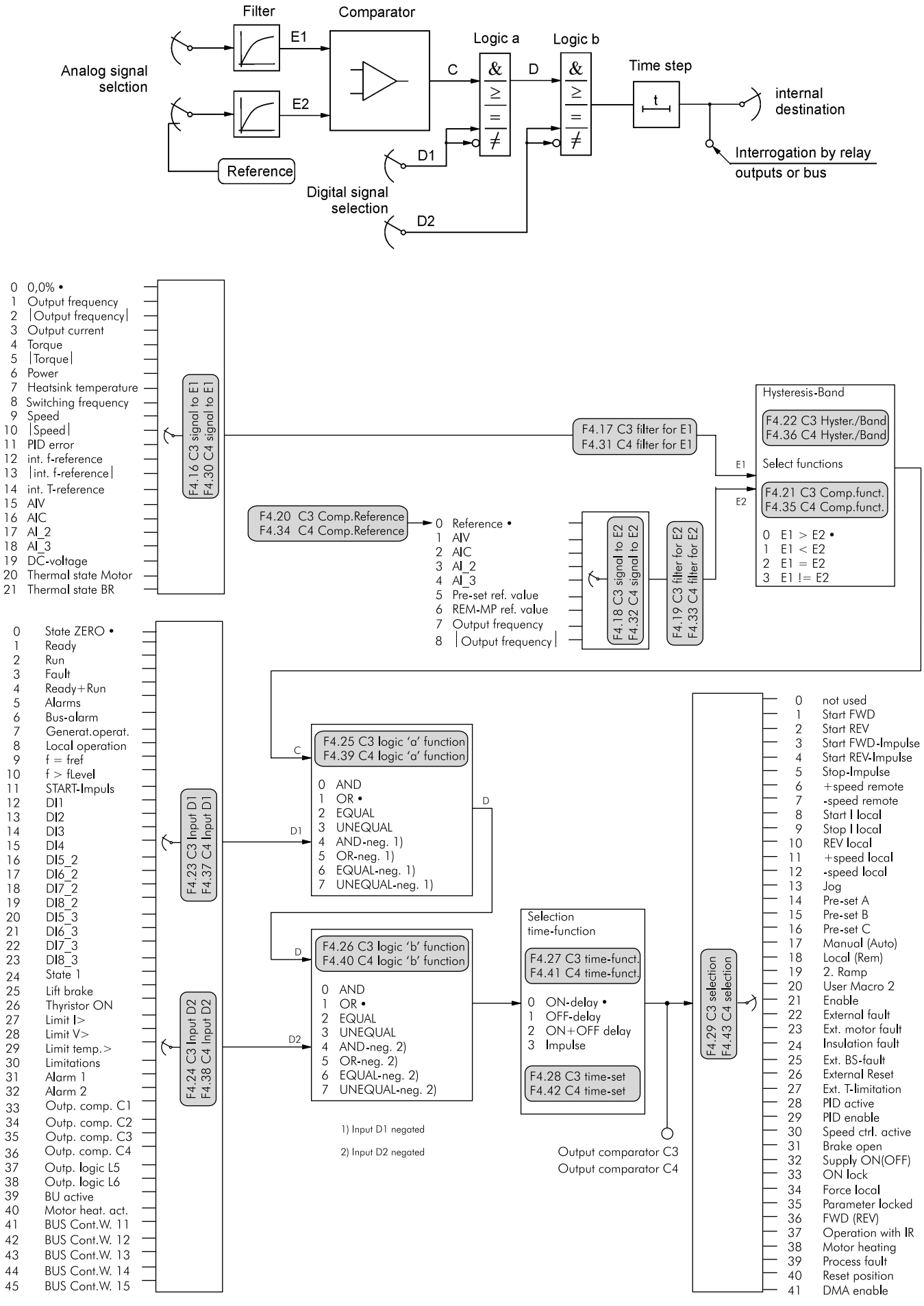
The inverter includes 4 comparators for monitoring various analog signals.
The produced signal can either be issued via the relay outputs with an adjustable time increment and/or used internally as a control signal.
Two of this blocks are designed as analog comparator levels with subsequent digital linking functions.
L5 and L6 are freely configurable logic modules.

Functional diagram of comparator C1 and C2:

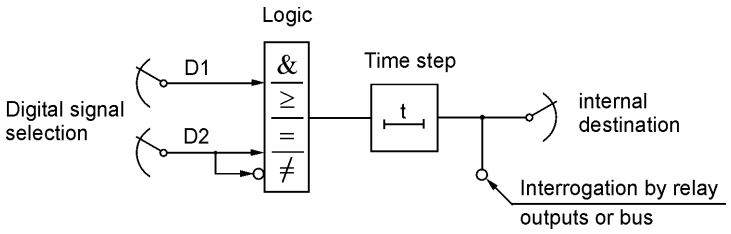


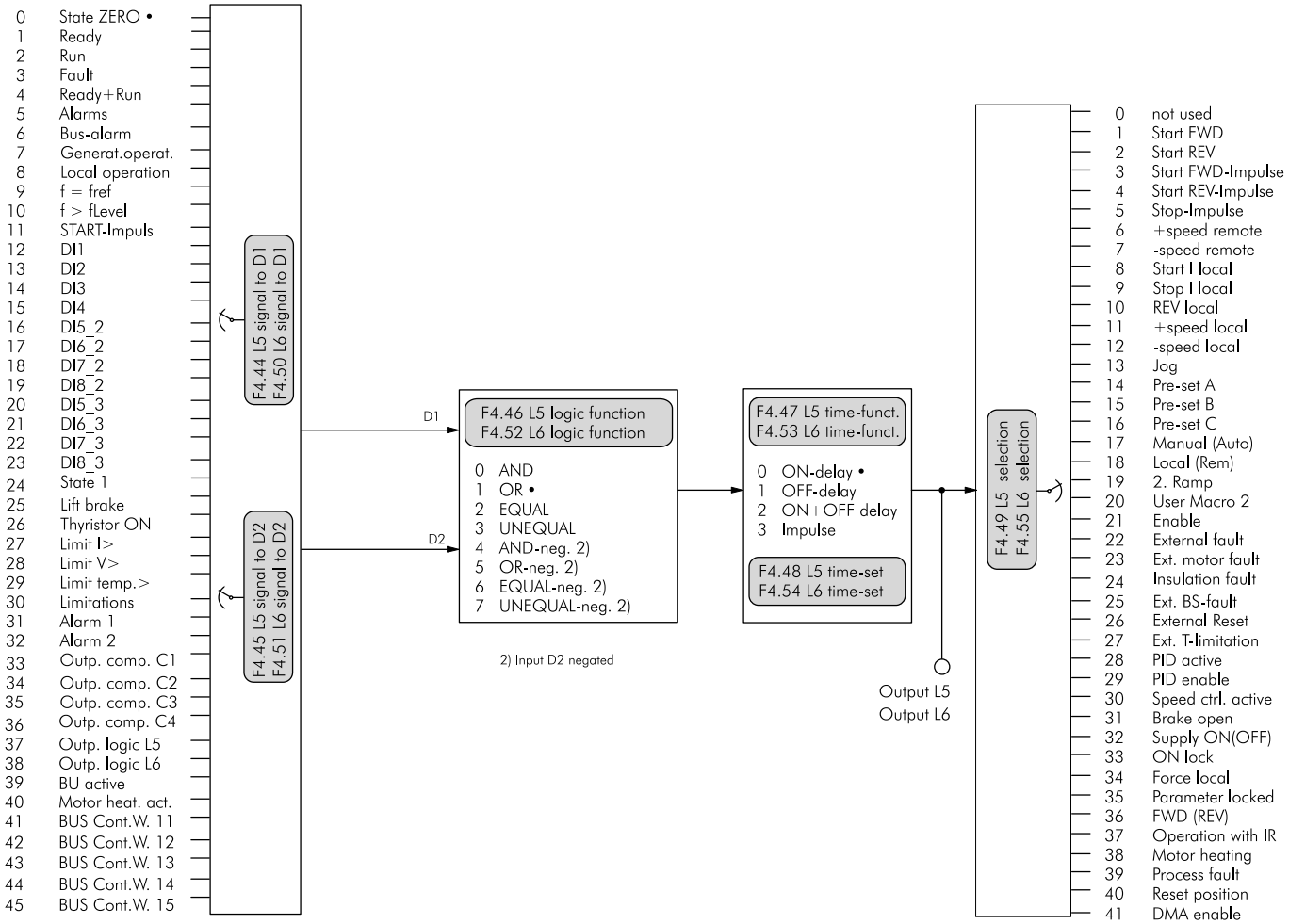


Functional diagram of comparator C3 and C4 with logic block:



Functional diagram of logic module L5 and L6:





F4.00	C1 signal to E1	VCB	0.0 %
F4.08	C2 signal to E1	VCB	0.0 %
F4.16	C3 signal to E1	VCB	0.0 %
F4.30	C4 signal to E1	VCB	0.0 %

0 ... 0.0% •
1 ... Output frequency 100% = fMAX (C3.01)
2 ... |Output frequency| 100% = fMAX (C3.01)
3 ... Output current 100% = Nom. motor current (B3.01)
4 ... Torque 100% = Nom. motor torque (B3.00, B3.04)
5 ... |Torque| 100% = Nom. motor torque (B3.00, B3.04)
6 ... Power 100% = Nom. motor power (B3.00)
7 ... Heatsink temperature 100% = 100 °C
8 ... Switching frequency 100% = 10 kHz
9 ... Speed 100% = fMAX in rpm (C3.01 x 60 / 2p)
10 . |Speed| 100% = fMAX in rpm (C3.01 x 60 / 2p)
11 . PID error 100% = 100 %
12 . int. f-reference 100% = fMAX (C3.01), after accel., before fs compensation
13 . |int. f-reference| 100% = fMAX (C3.01), after accel., before fs compensation
14 . int. T-ref 100% = Nom. motor torque (B3.00, B3.04)
15 . AIV 100% = 10 V (A4.00)
16 . AIC 100% = 20 mA (A4.02)
17 . AI_2 100% = 20 mA (A4.04)
18 . AI_3 100% = 20 mA (A4.06)
19 . DC-voltage 100% = 813 V for *MX plus*, 1200 V for *MX top*
20 . Thermal state Motor 100% = Nom. motor load (A2.12)
21 . Thermal state BR 100% = Nom. power of braking resistance (A3.12)

F4.18	C3 signal to E2	VCB	Reference value
F4.32	C4 signal to E2	VCB	Reference value

0 ... Reference value • to be set using F4.02
1 ... AIV 100% = 10 V (A4.00)
2 ... AIC 100% = 20 mA (A4.02)
3 ... AI_2 100% = 20 mA (A4.04)
4 ... AI_3 100% = 20 mA (A4.06)
5 ... Pre-set reference val. 100% = 100% or 100% = 163.84 Hz (A4.08)
6 ... REM-MP ref. 100% = 100% or 100% = 163.84 Hz (A4.10)
7 ... Output frequency 100% = fMAX (C3.01)
8 ... |Output frequency| 100% = fMAX (C3.01)

F4.01	C1 filter for E1	VCB	0.0...***0.1***...160 s
F4.09	C2 filter for E1	VCB	0.0...***0.1***...160 s
F4.17	C3 filter for E1	VCB	0.0...***0.1***...160 s
F4.31	C4 filter for E1	VCB	0.0...***0.1***...160 s

PT1 filter for the analog signal selected using E1.

F4.19	C3 filter for E2	VCB	0.0...***0.1***...160 s
F4.33	C4 filter for E2	VCB	0.0...***0.1***...160 s

PT1 filter for the analog signal selected using E2.

F4.02	C1 reference	VCB	-200.0...***0.0***...+200.0 %
F4.10	C2 reference	VCB	-200.0...***0.0***...+200.0 %
F4.20	C3 reference	VCB	-200.0...***0.0***...+200.0 %
F4.34	C4 reference	VCB	-200.0...***0.0***...+200.0 %

Provides a programmable reference value for comparator E2.

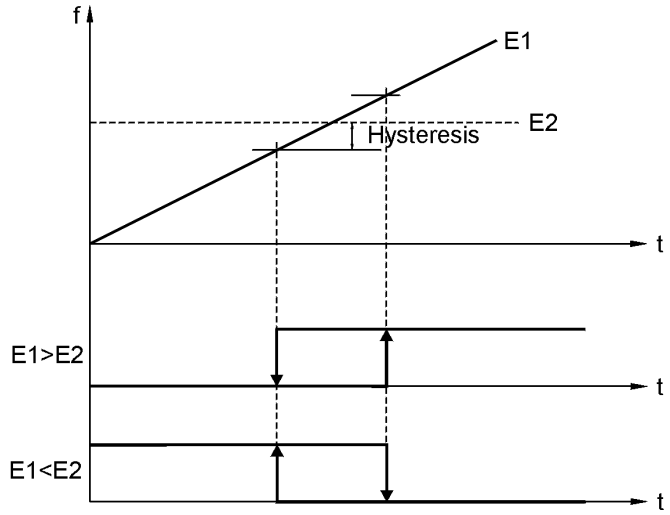
F4.03	C1 Comparator function	VCB	E1 > E2
F4.11	C2 Comparator function	VCB	E1 > E2
F4.21	C3 Comparator function	VCB	E1 > E2
F4.35	C4 Comparator function	VCB	E1 > E2

0 ... E1 > E2 •
1 ... E1 < E2
2 ... E1 = E2
3 ... E1 ≠ E2

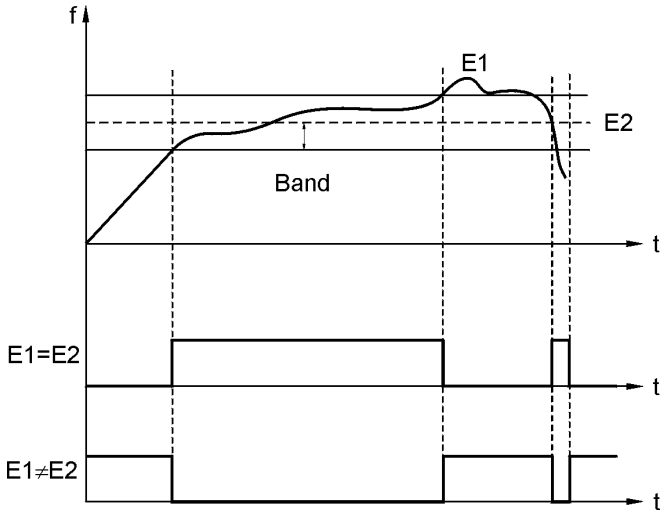
F4.04	C1 Comp. Hysteresis/Band	VCB	0.0...***5.0***...100.0 %
F4.12	C2 Comp. Hysteresis/Band	VCB	0.0...***5.0***...100.0 %
F4.22	C3 Comp. Hysteresis/Band	VCB	0.0...***5.0***...100.0 %
F4.36	C4 Comp. Hysteresis/Band	VCB	0.0...***5.0***...100.0 %

The comparator function defines the comparison criterion for the two analog input values (E1, E2). Using the symmetrically functioning hysteresis/bandwidth, the following output states are obtained:

Reaction with function:
E1 > E2 and E1 < E2



Reaction with function:
E1 = E2 and E1 ≠ E2



F Debug

F4.23	C3 Input D1	VCB	State ZERO
F4.24	C3 Input D2	VCB	State ZERO
F4.37	C4 Input D1	VCB	State ZERO
F4.38	C4 Input D2	VCB	State ZERO
F4.44	L5 signal to D1	VCB	State ZERO
F4.45	L5 signal to D2	VCB	State ZERO
F4.50	L6 signal to D1	VCB	State ZERO
F4.51	L6 signal to D1	VCB	State ZERO

State 1 for:

0 ..... State ZERO •	never
1 ..... Ready	Ready state
2 ..... Run	Run state
3 ..... Fault	Fault
4 ..... Ready + Run	Ready or Run state
5 ..... Alarms	Alarm (sum warning)
6 ..... Bus-alarm	bus communication is interrupted
7 ..... Generator operation	generator operation of motor
8 ..... Local operation	selected local operation
9 ..... f = fref	reference frequency is reached
10 ... f > fLevel	see D4.06, D4.07
11 ... Start impulse	4-second impulse following Start command
12 ... DI1	addressed DI1
13 ... DI2	addressed DI2
14 ... DI3	addressed DI3
15 ... DI4	addressed DI4
16 ... DI5_2	addressed DI5_2
17 ... DI6_2	addressed DI6_2
18 ... DI7_2	addressed DI7_2
19 ... DI8_2	addressed DI8_2
20 ... DI5_3	addressed DI5_3
21 ... DI6_3	addressed DI6_3
22 ... DI7_3	addressed DI7_3
23 ... DI8_3	addressed DI8_3
24 ... State 1	always
25 ... Lift brake	lift brake (see crane function C6.01)
26 ... Thyristor-ON	intermediate circuit loaded
27 ... Limit I>	current limitation active *) or heatsink temp.>
28 ... Limit V>	voltage limitation active *)
29 ... Limit Temp>	motor protection (thermal motor model) active
30 ... Limitations	sum message for all limitations
31 ... Alarm 1	see Appendix A
32 ... Alarm 2	see Appendix A
33 ... Output of comp. C1	
34 ... Output of comp. C2	
35 ... Output of comp. C3	
36 ... Output of comp. C4	
37 ... Output logic module L5	
38 ... Output logic module L6	
39 ... BU active	
40 ... Motor heating active	
41 ... Bus control word 11	
42 ... Bus control word 12	*) The message for this limitation is
43 ... Bus control word 13	currently not in function!
44 ... Bus control word 14	
45 ... Bus control word 15	

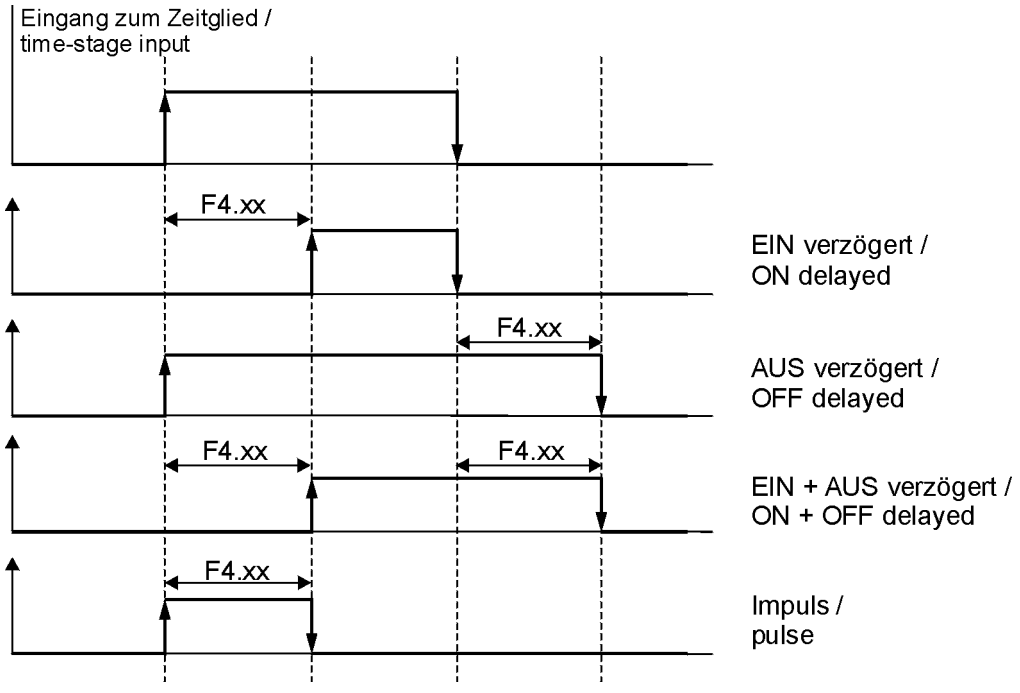
F4.25	C3 logic 'a' function	VCB	OR
F4.26	C3 logic 'b' function	VCB	OR
F4.39	C4 logic 'a' function	VCB	OR
F4.40	C4 logic 'b' function	VCB	OR
F4.46	L5 logic function	VCB	OR
F4.52	L6 logic function	VCB	OR

0 ... AND
1 ... OR •
2 ... EQUAL
3 ... UNEQUAL
4 ... AND - negated input D1 (D2) negated !
5 ... OR - negated input D1 (D2) negated !
6 ... EQUAL - negated input D1 (D2) negated !
7 ... UNEQUAL - negated input D1 (D2) negated !

F4.05	C1 time function	VCB	ON-delay
F4.13	C2 time function	VCB	ON-delay
F4.27	C3 time function	VCB	ON-delay
F4.41	C4 time function	VCB	ON-delay
F4.47	L5 time function	VCB	ON-delay
F4.53	L6 time function	VCB	ON-delay

0 ... ON - delay •
1 ... OFF - delay
2 ... ON + OFF - delay
3 ... Impulse

F4.06	C1 time set	VCB	0.0...***0.0***...3200.0 s
F4.14	C2 time set	VCB	0.0...***0.0***...3200.0 s
F4.28	C3 time set	VCB	0.0...***0.0***...3200.0 s
F4.42	C4 time set	VCB	0.0...***0.0***...3200.0 s
F4.48	L5 time set	VCB	0.0...***0.0***...3200.0 s
F4.54	L6 time set	VCB	0.0...***0.0***...3200.0 s



F4.07	C1 selection	VICB	not used
F4.15	C2 selection	VICB	not used
F4.29	C3 selection	VICB	not used
F4.43	C4 selection	VICB	not used
F4.49	L5 selection	VICB	not used
F4.55	L6 selection	VICB	not used

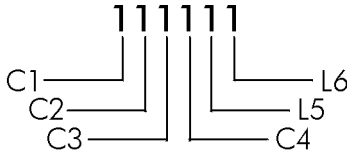
0 ... not used •
1 ... Start FWD
2 ... Start REV
3 ... Start FWD impulse
4 ... Start REV impulse
5 ... Stop impulse
6 ... +speed remote
7 ... -speed remote
8 ... Start impulse local
9 ... Stop impulse local
10 . REV local
11 . +speed local
12 . -speed local
13 . Jog
14 . Pre-set A
15 . Pre-set B
16 . Pre-set C
17 . Manual (Auto) make contact = f-ref Manual
18 . Local (Remote) make contact = local control (E4.00 to 03)
19 . 2.ramp
20 . User Macro 2 make contact = user macro 2
21 . Enable break contact = lock - free wheel
22 . External fault parametrize additionally E3.11...13
23 . External motor fault parametrize additionally E2.13...15
24 . Insulation fault parametrize additionally E3.18...20
25 . External BS-fault parametrize additionally E3.09...10
26 . External Reset
27 . External T-limitation
28 . PID active
29 . PID enable
30 . Speed control active
31 . Brake open
32 . Supply ON/OFF only with activated contactor control
33 . ON lock
34 . Force local
35 . Parameter locked
36 . FWD (REV)
37 . Operation with IR
38 . Motor heating ATTENTION: The motor data B3 must be set correctly !
39 . Process fault parametrize additionally E3.14...17
40 . Reset Position
41 . DMA enable

Using the parameters "selection", the respective comparator/logic module output can be assigned directly and internally (without detour via a relay output and digital input).

Each function can only be selected 1x. "Double assignments are not possible!"
Settings that have already been selected using one of the digital inputs D2, the B6 "Bit x - Control word" or another comparator/logic module cannot be set again.

F4.56	C1-L6 status	—	read only

This parameter shows the output state of the comparator logic modules C1 to L6 (from left to right). Leading zeros are suppressed.



F5

F5.00	Sensor A - Offset	—	read only
F5.01	Sensor B - Offset	—	read only

Parameters F5.00 and F5.01 indicate the current offset settings for the current sensors.
If necessary, these values can be taken over for the corresponding offset parameters F5.02...F5.06 (wait for steady-state, ~5 min).

F5.02	Sensor A 5kHz offset	VCB	-1000...***0***...+1000
F5.03	Sensor B 5kHz offset	VCB	-1000...***0***...+1000
F5.04	Sensor A 10kHz offset	VCB	-1000...***0***...+1000
F5.05	Sensor B 10kHz offset	VCB	-1000...***0***...+1000
F5.06	Offset tuning	VCB	active

0 ... not active
1 ... active •

See the notes in the Service Manual!

F6 Code lock

F6.00	Code	VB	0...***0***...9999
F6.01	Code value	VB	0...***0***...9999

The code lock is opened if the code value corresponds with the set number of the code. With every "Mains on", F6.00 - Code automatically resets to 0.

F6.02	Parameter Access	V	Keypad

0 ... Keypad •
1 ... Fieldbus
2 ... RS232/Gateway

F6.03	Pulse inhibit	VICB	No

0 ... No • Inhibit not active, the inverter is enabled
1 ... Yes The inverter is disabled and can be only enabled by resetting the parameter.

This parameter is able to lock the software of the inverter. "Disabled" is displayed.
The PC tool MATRIX sets the parameter to "1 yes" during transmission of parameters. So a start-up of the drive is prevented.

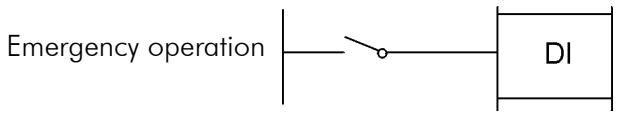
Emergency operation (Special code necessary !)

This function allows an Emergency operation, at which all functions are oriented on human protection and only secondary oriented on the protection of the drive, e.g. ventilation system in a tunnel.
This function can be activated by digital input DI3 and is reported by a entry in the fault memory F3 (snapshot).

Parametrization:

- Input of the code value in parameter F6.00, independent from the adjustment of parameter F6.01, to enable the function (ask the manufacturer for the code).
  F6.00 is automatically reset to 0.
- Parameter D2.02 for selection of the function of digital input DI3 (terminal 13) can be only set to position "50 Emergency operation".
- The enable of the function "Emergency operation" can only be cancelled by setting all parameters back to factory default via parameter F2.00.
- The enable of this function is like an internal parameter, which is stored in the user macro and is copied during transmittion of all parameters from and to the PC.

Control:



DI3 terminal 13
Make contact: the function is started, parts of the protection functions are not active.
Break contact or input not used: normal operation.
The digital input has a 1s-filter to eliminate disturbances.

- Actual trips are automatically reset by the command "Emergency operation".
- For feedback "Alarm 1" is set.

Display, indication:

- The display "Emergency operation" is indicated in the status field (right bottom)
- A1.03 shows: "Emergency operation"

Switched-off protection functions:

- (60) " Motor Overload" protection model of the motor is automatically set to "Alarm"
- (49) "Overtemp. 1" monitoring of the inverter temperature not active → Alarm
- (55) "Motor Trip" External motor trip (via terminals) not active → Alarm
- (54) "Ext. Fault" External fault (via terminals) not active → Alarm
- (56) "Insulation Trip" Insulation fault not active → Alarm
- (58) "Motor Temp.>" Motor-Thermistor not active → Alarm
- (59) "Thermistor SC" Motor-Thermistor not active → Alarm
- (64) "Ext. BS-fault" External braking unit fault (via terminals) not active
- (65) "Charge protection" Monitoring of the charging resistors not active

Further settings of functions:

- Autoreset exceeded to max.20 per 5 minutes
- Switching frequency is limited to 2,5kHz

Remarks for the user:

- E2.11 "n>> protection" do not set to "Trip"
- E2.16 "Underload Response" do not set to "Trip"
- E3.03/04 "Loss of 4mA" do not set to "Trip"
- E3.06 "BR overload React." do not set to "Trip"
- If a quick change of direction is necessary, the function "Motor brake" can be activated by C1.03.

In operating mode "Emergency operation", the frequency inverter is not protected against overload. Therefore, we cannot guarantee normal operation after emergency operation !!!

Limitation messages

Message	Limit. V >	Limit. I >	Limit. Temp >	Limit. sum	Description, possible causes
(11) BU active					Braking unit (*BU plus* controlled by the inverter) active (power of the DC link is derived by the braking unit and the braking resistor) (message "BU active" on the digital outputs)
(28) delta Ud >				✓	Pulse inhibit (charging connection open) due to dynamic undervoltage
(30) U-Motor >				✓	Pulse inhibit because motor current greater than thyristor current
(33) U-DC limitation *)	✓			✓	Generator load (rapid deceleration) leads to increase in output frequency (to prolong deceleration time).
(34) I-limitation motor.*)		✓		✓	Motor current limitation is active and reduces the output frequency.
(35) I-limitat. generator *)		✓		✓	Generator current limitation is active and increases the output.
(36) f-skip				✓	The set frequency range masking is active.
(37) Motor temperature >			✓	✓	The motor protection model set with parameters E2.02 to E2.07 limits the maximum current. 1)
(38) Drive temperature >		✓		✓	Too high temperature at the heatsink or too high continuous current (at less than 1 (5) Hz) leads to a reduction of maximum current. 1)

Meaning: *) This limitation is currently not in function.
✓ The limitation is part of the "Limitation sum message" and of "Limitation V >", "Limitation I >" or "Limitation Temp. >".
1) "Limitation active" means that the maximum current is reduced to less than 150 % $I_{N"C"}$ independent of the actual output current.

The Limitation messages are displayed only, if parameter A6.03 will be set to "1 visible".

The actual limitations or alarm messages are displayed in parameter A1.03 and can be requested via the PZD channel of bus communication (B6.11 a.s.o.).

Alarm messages

Message	Alarms (sum)	Alarm	Bus alarm	Description, possible causes
(15) Emergency operation	-	1	-	The emergency operation is active.
(41) Memory fail	✓	-	-	The error memory has only one valid block left (15 records already marked "invalid") → replace flash
(42) DSP program (43-46) Language 1 to4 (49) Language 5 (47-48) Font; Bitmap	✓	-	-	Program error in the respective segment → replace flash
(57) Bus Comm2	P	-	*)	Communication error at bus (Profibus or RS232; bit 10: control OK=0)
(58) Undervoltage 1	P	1 or 2	-	Undervoltage parametrized for warning with E3.21 and E3.22.
(59) Motor temp.> (60) Thermistor SC	P	1 or 2	-	This motor thermistor evaluation is parametrized for warning with E2.01
(61) Overspeed	P	1 or 2	-	Motor speed monitoring is parametrized for warning with E2.11.
(62) Braking resistor overload	P	1 or 2	-	The on-time has exceeded the limit set with parameter E3.06...08 → switch off drive and wait until resistor has cooled off.
(64) Motor overload	P	1 or 2	-	The actual motor load is higher than the limit set with E2.02 to E2.07.
(65) Loss of 4 mA	P	1 or 2	-	One of the monitored analog inputs has an actual signal less than 3 mA and the fault is parametrized for alarm with E3.03 to E3.05.
(66) External fault	P	1 or 2	-	External fault is parametrized for alarm with parameters E3.11 to E3.13.
(67) Ext. Motor fault	P	1 or 2	-	External motor fault is parametrized for alarm with E2.13 to E2.15.
(68) Insulation fault	P	1 or 2	-	The Insulation fault is parametrized for alarm with E3.18 to E3.20.
(69) Process fault	P	1 or 2	-	The External Process fault is parametrized for alarm with E3.14 to E3.17.
(70) Underload Motor	P	2	-	The actual motor load is lower than the limit set with E2.16 to E2.21.
(71) Maintenance	P	1	-	The actual value of the "Power On hour" counter is higher than the value set by A5.04 "Maintenance at". → It could be an information for cleaning the drive or to replace the fan(s).

Meaning:
- ✓ The message is always part of "Alarms".
- 1 or 2 Some messages can be parametrized to "Alarm 1" or "Alarm 2".
- P If "Alarm 1" or "Alarm 2" is set, the message is automatically part of "Alarms".
- *) If Bus Comm2 is parametrized for "Alarm", it is automatically part of "Alarms".

Trip messages

The actual trip messages are displayed in parameter A1.04 und can be requested via the PZD channel of bus communication (B6.11 a.s.o).

Confirmation of errors

An error can be confirmed in one of the following 5 ways:

- By pressing the O/Reset key on the keypad
- By switching off the mains supply and 24 V buffer voltage if provided
- By using a digital input to reset (see D2.00 to D2.10)
- With the activated Autorestart function (see E3.00)
- m With a reset signal on the bus (e.g. Profibus)

In the case of active steady signals Start FWD or Start REV, the remedy and resetting of a trip is followed by an automatic restart!

(Priority) Message	Help F1	Description, possible causes
(0) +24V off	F1.28	no trip - 24V control voltage was switched off (mains voltage and 24V buffer voltage)
(1) UI Fault 1.0 (2) UI-Fault 2.0 (3) UI-Fault 2.1 (4-6) UI-Fault 3.0 to 3.2 (7-9) UI-Fault 4.0 to 4.2 (12) UI-Fault 5.0 (13) UI-Fault 6.0 (14) UI-Fault 7.0	F1.21	Defect on control print user interface (UI) *Perform control circuit test* *Replace component* The inverter distinguishes eight types: UI-Fault 1: Processor error (replace UI) UI-Fault 2.0: Code error (replace flash) UI-Fault 2.1: Code error (replace flash) UI-Fault 3: Task overflow (replace UI+ flash) UI-Fault 4: Backup error (replace flash) UI-Fault 5: LCD error (replace UI) UI-Fault 6: FLASH error (replace flash) UI-Fault 7: Error in shift register (replace UI)
(35) AR-Fault 1.0 (48) AR-Fault 2.0 (10) AR-Fault 3.0 (11) AR-Fault 3.1 (23) AR-Fault 3.2	F1.19	Error on print "Drive control" *Replace component* The inverter distinguishes three types: AR-Fault 1: ref. voltage error, ext. 24 V buffer volt. too low AR-Fault 2: ASIC error AR-Fault 3.x: error in EEPROM (replace)
(15-18) Int. Comm. 1.0-1.3 (20) Int. Comm. 1.4 (19) Int. Comm. 2.0 (37) Int. Comm. 3.0	F1.20	Error in internal communication *Reset ?* *Replace electronics* The inverter distinguishes three types: Int. Comm. 1.0 to 1.4: Control-Link error → no communication Int. Comm. 2: AR program wrong or incorrectly transferred Int. Comm. 3: Enable error -> screen input DI5 !!
(21) Com. card-fault	F1.25	PB01 cannot be initialized properly PB01 defect or installed incorrectly

(Priority) Message	Help F1	Description, possible causes
(22) BUS-Com.1	F1.23	Watch-Dog: Error during serial data transfer between DP master and PB01. The inverter did not receive data from the PLC (DP master) for longer than the set Watch-Dog time - bus wire interrupted or PLC error.
(31) Emergency operation	–	no trip - Emergency operation has been started
(32) Fault History	F1.29	Invalid entry in error memory Error memory has no entries yet or is defect (replace flash)
(33) Overcurrent 1 (40) Overcurrent 2	F1.04	Overcurrent at inverter output *Activate power part test!* *Short ? or earth fault ?* The inverter distinguishes two types: Overcurrent 1: I>> Overcurrent 2: Difference I>> (sizes 5 and 8 only)
(34) Overvoltage	F1.02	Overvoltage in thyristor *Decel. time too short ? or mains voltage too high ?* *external braking unit connected and OK ?* *Failure of mains phase during operation ?* *Earth fault (in IT-mains) in the motor or the motor cable ?*
(36) PoCi-Fault	F1.18	Defect in power circuit *Replace respective components.* (In *>pDRIVE< MX plus*, sizes A and B, this trip message may also be displayed in case of overcurrent, even without the power part actually being defect!)
(38) BU fault	F1.13	Braking unit fault Trip of the braking unit controlled by the inverter *Short-circuit in the braking unit BU plus ?* *Short-circuit in the braking resistor ?* *Overtemperature of BU plus ?* *No braking resistor connected ?* *Is C1.03 in position 5 or 6 and no BU plus connected?* *Is C1.03 in position 6 and only one BU plus connected ?*
(41) ZB Temp>	F1.17	Overtemperature in central component *Temperature in control part too high. Fan OK ?* *Check cabinet ventilation*
(49) Overtemp. 1 (47) Overtemp. 2	F1.16	Temperature at heatsink *Check device fan, cubicle ventilation, and possible air filter.* *Ambient temperature too high ?* The inverter distinguishes two types: Overtemp. 1: cooler temperature too high Overtemp. 2: A3.03 > 100°C: overtemp. or Temperature sensor KS A3.03 < -25°C: temperature sensor wire break
(50) BUS-Com.2	F1.24	Profibus DP master does not send "Guide OK" in control word Bit 10 is set to 0 during bus control - error in PLC or in bus module

(Priority) Message	Help F1	Description, possible causes
(51) Undervoltage 1 **(52) Undervoltage 2**	F1.03	Undervoltage in DC link: *Mains voltage available ?* *All phases available ?* *Mains fuses OK ?* The inverter distinguishes two types: Underv. 1: U<< in operation, longer than permissible with parameter E3.21...22 Underv. 2: no mains voltage despite ON command from contactor control after 3 seconds (12 sec for MX size A and B)
(53) Crane-OL	F1.22	Load too big – *Current limitation during acceleration ?* Increase acceleration ramp – *Current limitation during deceleration ?* Increase deceleration ramps or raise power of braking unit – *Trip message while fast speed function is active ?* Reduce maximum frequency – *Current regeneration defect ?* –*Inverter heatsink insufficient ?* –The digital input for brake feedback "Brake open" is in use and feedback signal has not been applied yet after 80% of the DC current time (for < 1 Hz). –The same time monitoring is performed between "Lift brake" and "Brake closed".
(54) Ext. fault	F1.05	External Trip An external trip is reported by a terminal strip function Proper setting for parameter E3.11...13
(55) Mot. Trip	F1.09	Motor trip An external motor trip is reported by a terminal strip function. Proper setting for parameters E2.13...15
(56) Insul. Trip	F1.12	Insulation trip Ground contact in motor or motor cable
(57) 4 mA Error	F1.06	4 mA- fault A 4-20 mA ref. value is < 3 mA ->Wire break ? Proper setting for parameters E3.03...5 ?
(58) Motor Temp>	F1.07	Motor thermistor has picked up Motor overloaded ? External ventilator OK ?
(59) Thermistor SC	F1.08	Thermistor short circuit Check thermistor wiring
(60) Mot. Overload	F1.10	Motor overload ! The thermal motor model has performed an overload trip. See parameters E2.02 to E2.07
(61) Stall protection	F1.11	Stall protection The motor does not start, is mechanically blocked or much overloaded.
(62) Overspeed	F1.14	Overspeed The speed is greater than the maximum value set with parameter E2.11...12.

(Priority) Message	Help F1	Description, possible causes
(63) Encoder Trip	F1.15	Fault at encoder or encoder interface ! Encoder, cable or SFB option (speed feedback in inverter) defect. The actual speed (recognized by the encoder) differs from the output frequency more than 5times of the nom. motor slip Cause: Wire break, defect encoder or wrong setting of switching frequency.
(64) Ext. BS-fault	F1.13	Trip of external braking unit Check braking unit BS und braking resistor!
(65) Charge Protect.	F1.26	Charge resistance monitor: Mains switched on/off too often or charging connection defect (the error lasts approx. 5 minutes !)
(66) ON Lock	F1.27	ON lock: Due to failure of mains fuses, contactor, cubicle overtemp., charging connection defect or ventilator protection switch
(67) BR overload	-	Overload of the brake resistor The on-time of the brake resistor is greater than the value set in parameter E3.06...08.
(69) Process fault		Process fault An external trip is reported by a terminal strip function Proper setting for parameter E3.14...17 ?
(70) Underload Motor	-	Underload on the motor shaft The load is smaller than the minimum set with parameter E2.16...21.

See Service Manual for more detailed information about service problems, such as error diagnosis, troubleshooting, spare parts storage etc.

MATRIX 2.0 Software

REMARKS FOR INSTALLATION AND USE

1. Required devices

In addition to your computer you will need the serial cable marked CABLE PC-MX.
This cable connects one of the parallel ports of your computer with the RJ45 port beneath the keypad on the user interface.

2. Hardware requirements

Minimum system requirements:

- Pentium or higher based PC
- Windows 95, 98: 32 MB RAM
- Windows NT4, 2000, ME and XP: 64 MB RAM
- min. 30 MB free space on hard disk for programs and produced data
- Monitor resolution: 1024 x 768 or higher
- MS Internet Explorer 5.x or higher
- In addition to the mouse port a second free serial port is required !!

3. Software installation

- Insert the MatriX 2.0 CD in your CD-ROM drive.
- Setup starts automatically. If the Setup does not start automatically, open the file "setup.exe" in the root directory of the CD-ROM.
- Follow the instructions on the screen.
- Following on "Install MatriX 2.0" please also install the essential MASK-Files by "Install MASK-Files 2.0". Also install the essential BIN-Files after "Install FLASHcopy 2.0".

MASK-Files:

MASK-Files are language-based text-files of the respective inverter software, which is responsible for the right language display in MatriX 2.0. If the inverter contains a software version, which MatriX 2.0 does not recognise, the corresponding MASK-Files must be installed. The program automatically asks for installation.

By activating the DOWN-Mode the transmission time can be reduced significantly (only possible during stand still of the inverter) !

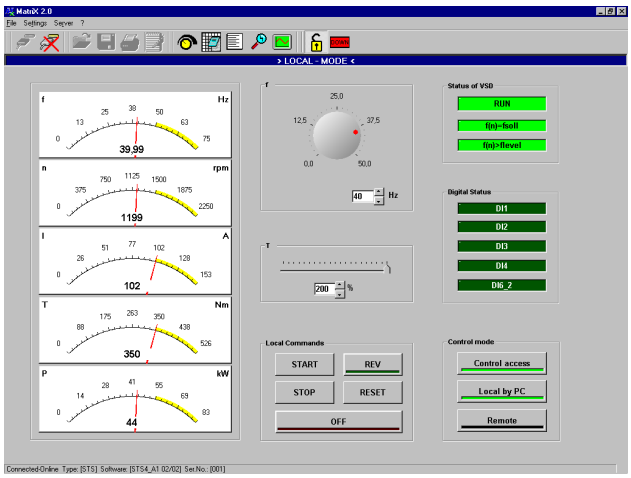
As an alternative to the installation of the MASK-Files via the inverter, you can also download the Update-Package from www.pdrive.com.

4. Program features

Function of icons:

	Connection to FI This icon makes a serial connection to the frequency inverter via the set interface and baudrate (adjustable under "Server").
	Disconnection of FI Interrupts the serial connection with the frequency inverter.
	Open Depending on the active window, this icon opens parameter lists, failure memory lists or data of the actual value plotter.
	Store Depending on the active window, this icon stores parameter lists, failure memory lists or data of the actual value plotter.
	Print Prints the actual document.
	Export Provides an export of parameter lists and failure memory lists as text-file.
	Local control For monitoring and online-control of a frequency inverter.
	Parameter editor With the help of the displayed Matrix, all parameters can be online requested, changed and failsafe stored online in the inverter.
	Docu mode Documents the actual parameter settings and actual values of the inverter.
	Failure memory Support for documentation and analysis of the last 15 trips in the failure memory of the frequency inverter.
	Actual value plotter To record analog and digital states during operation.
	Activating parameter access If parameter access is activated, the adjustment of inverter parameters is possible.
	Activating DOWN-Mode (only possible during stand still of the inverter !) Activating the DOWN-Mode enables an increase of the transmission rate between frequency inverter and PC, but the actual application at the inverter is stopped.

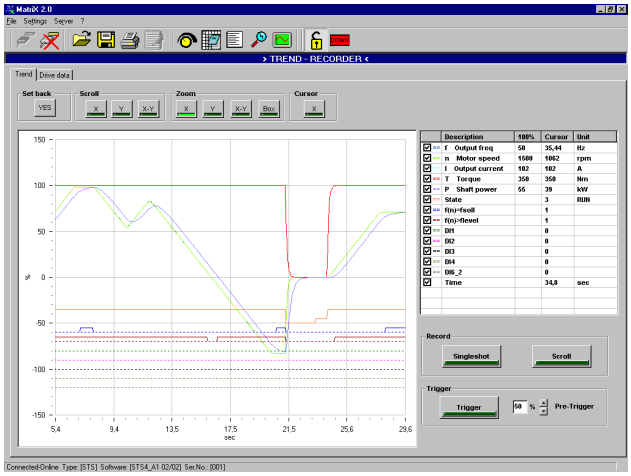
The program MATRIX includes the following functions:



Local control

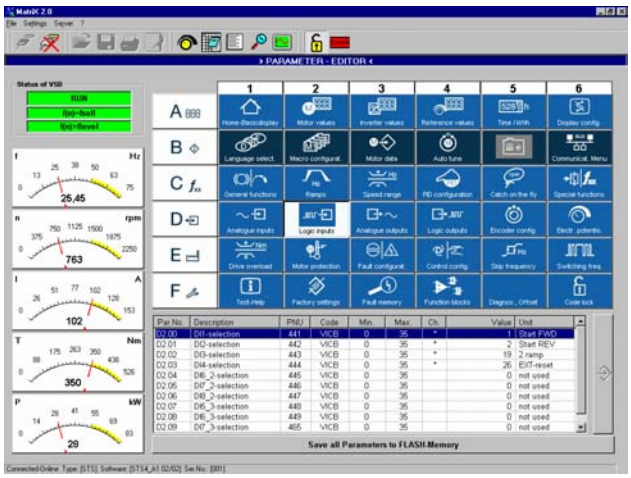
For monitoring and online-control of frequency inverter. With the "Local" button you can switch between monitoring and control mode.

The contents of the analog display instruments and some digital status fields can be changed using the parameter editor (matrix area B6 "Communication Menu", parameter group B6.11, B6.13, B6.15, B6.17, B6.19 and B6.26 to B6.30).



Actual value plotter

Enables a recording of 5 analog and 8 digital states during operation. The analog and some digital actual values, which should be recorded, can be changed using the parameter editor (matrix area B6 "Communication Menu", parameter group B6.11, B6.13, B6.15, B6.17, B6.19 and B6.26 to B6.30).
Recording is started and stopped by pressing the icon "Record" (maximum record time 200 s at a runtime of 4000 s in Scroll-mode). The size of the plot depends on the actual zoom.



Parameter editor

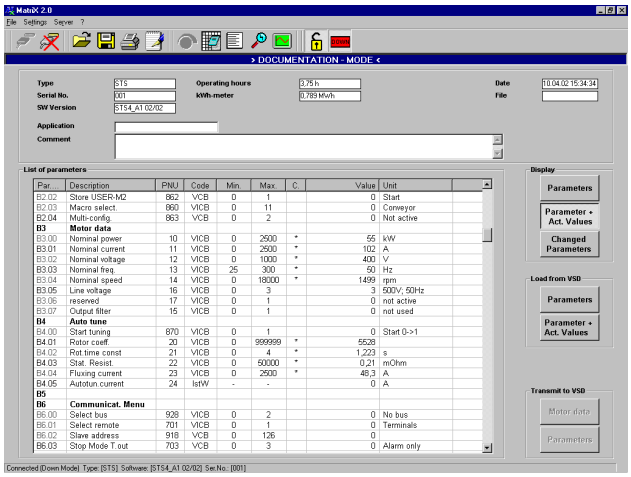
With the displayed matrix, all parameters can be requested online and changed, if necessary. In order to be able not only to display but also to modify parameters, parameter access is necessary (choose icon "Parameter access").

After performing the routines:

- A1.00 Home field "Save Backup"
- B2.01 Macro configuration "Store USER-M"
- B4.00 Autotuning "Start tuning"
- F1.00 Help functions "Test power part"
- F2.00 Factory settings "Return factory application"
- F2.01 Factory settings "Return factory motor"

the respective line 0 must always be sent.

!! All modified parameters must be stored failsafe by selecting A1.00 "Save Backup" or by pressing the button "Save all parameters to FLASH-Memory", before mains supply is disconnected !!

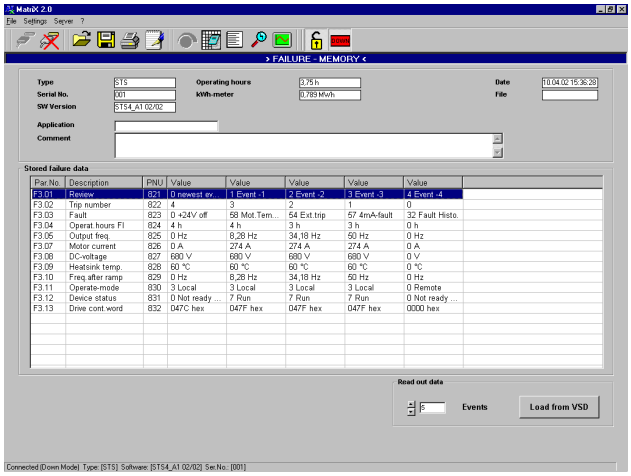


Docu mode

Is used for documentation of actual parameter settings. In addition, stored parameter data can be transferred to any number of other inverters.
A complete list of parameters (including actual values, if desired) can be plotted by pressing the "Print" icon.
During stand still of the drive the transmission time can be decreased by DOWN-Mode !

ATTENTION:
The program transfers the actual working parameters, but not:

- the contents of the User-Macros
- the set language (parameter B1.00)
- the slave address (parameter B6.02)



Failure memory

Support for documentation and analysis of the last 15 trips in the failure memory of the frequency inverter.
By pressing the "Print" icon a complete list of parameters is plotted (including actual values, if desired).
During stand still of the drive the transmission time can be decreased by DOWN-Mode !

5. Remarks for operation

The MATRIX 2.0 software package works with all *>pDRIVE< MX* devices. At ELVOvert MX devices some functions have only limited functionality.

To ensure proper operation, we recommend that you disable any screen savers.

If you keep your mouse pointer over an icon or display, a short help text will appear.

6. Uninstalling

Press the Start-Button and select Settings – System requirements. Double-click on the symbol for software and follow the instructions to remove MatriX 2.0.

The following parameters can only be read out or modified on the PC using the MATRIX software. All these parameters are assigned to MATRIX area A1, which is reserved for the local keypad of the basic display (Home).

A1.00	Save backup	VB	Routine

0 ... Start 0→ 1
1 ... Store backup
2 ... Stored

Unlike local mode on the keypad, the Save command is not issued automatically when you switch to the basic display (Home area). When parametrizing with the software program MATRIX, the parameter A1.00 is used for saving.

Procedure:
1. Send line 1 "Store backup"
2. Wait for feedback 2 "Stored"
3. Send line 0 "Start - 0 → 1"

A1.01	Device Mode	—	read only

0 ... " "
1 ... Mains disconnected
2 ... Local only
3 ... Mains off
4 ... Disabled
5 ... Stop
6 ... Loading
7 ... not enabled
8 ... Mains missing
9 ... Trip
10 . Autotuning running
11 . Test power part
12 . Heating Motor
13 . Alarm

The device mode corresponds to the display in field 1 of the basic display (Home).

A1.02	Operate Mode	—	read only

0 ... Remote
1 ... Rem Loc
2 ... Loc Rem
3 ... Local
4 ... Line
5 ... Line Loc
6 ... Loc Bus
7 ... Local

The operate mode corresponds to the display in the field "Operate-Mode" of the basic display.

A1.03	Status + Alarms	—	read only

This parameter displays the current device state (with the priorities):

– Display operating situation (lowest priority)
– Display selected parameter set
– Display limitation action
– Display warning (highest priority)

All items of parameter A1.03 are listed in the table "Limitation and Alarm messages" in the BUS manuals.

See Appendix A for the Limitation and Alarm messages.

A1.04	Trip message	—	read only

This parameter displays the current device state:

– Display trip

All items of parameter A1.04 are listed in the table "Trip messages" in the BUS manuals.

See Appendix A for the Trip messages.

A1.05	LED-state	—	read only

0 ... Not READY
1 ... READY
2 ... RUN
3 ... TRIP

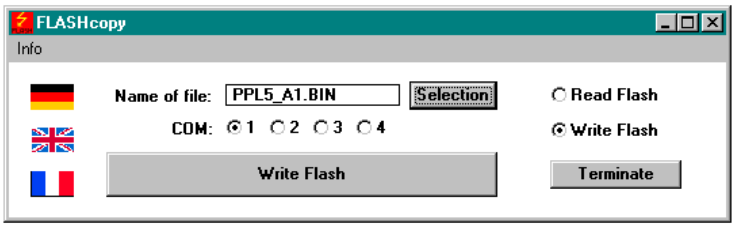
The LED state corresponds to the device state, which is displayed on one of the 3 colored LEDs on the keypad. If no LED is lit up, this corresponds to the state "Not READY".

FLASHcopy

1. Installation

The system requirements are the same as for MatriX 2.0.
For installation use the MATRIX setup. Uninstall FLASHcopy like the MATRIX 2.0 software.

2. Program features



The program FLASHcopy is used to read and write to the FLASH memory on the USER INTERFACE, which contains the inverter program.
The main application of "FLASHcopy" is the updating of your inverter software version. However, all the parameters set in the inverter are deleted thereby, and the "Autotuning" function must be repeated.

Moreover, you can read out all the current software stored on this chip, and save it to a file. This makes the duplication of user-specific settings for the operation of several inverters with the same configuration much easier.

First, select the correct COM port. If you have selected the wrong COM port, a timeout will be reported later, when you read or write to the chip.
Select whether you want to read or write to the FLASH chip.

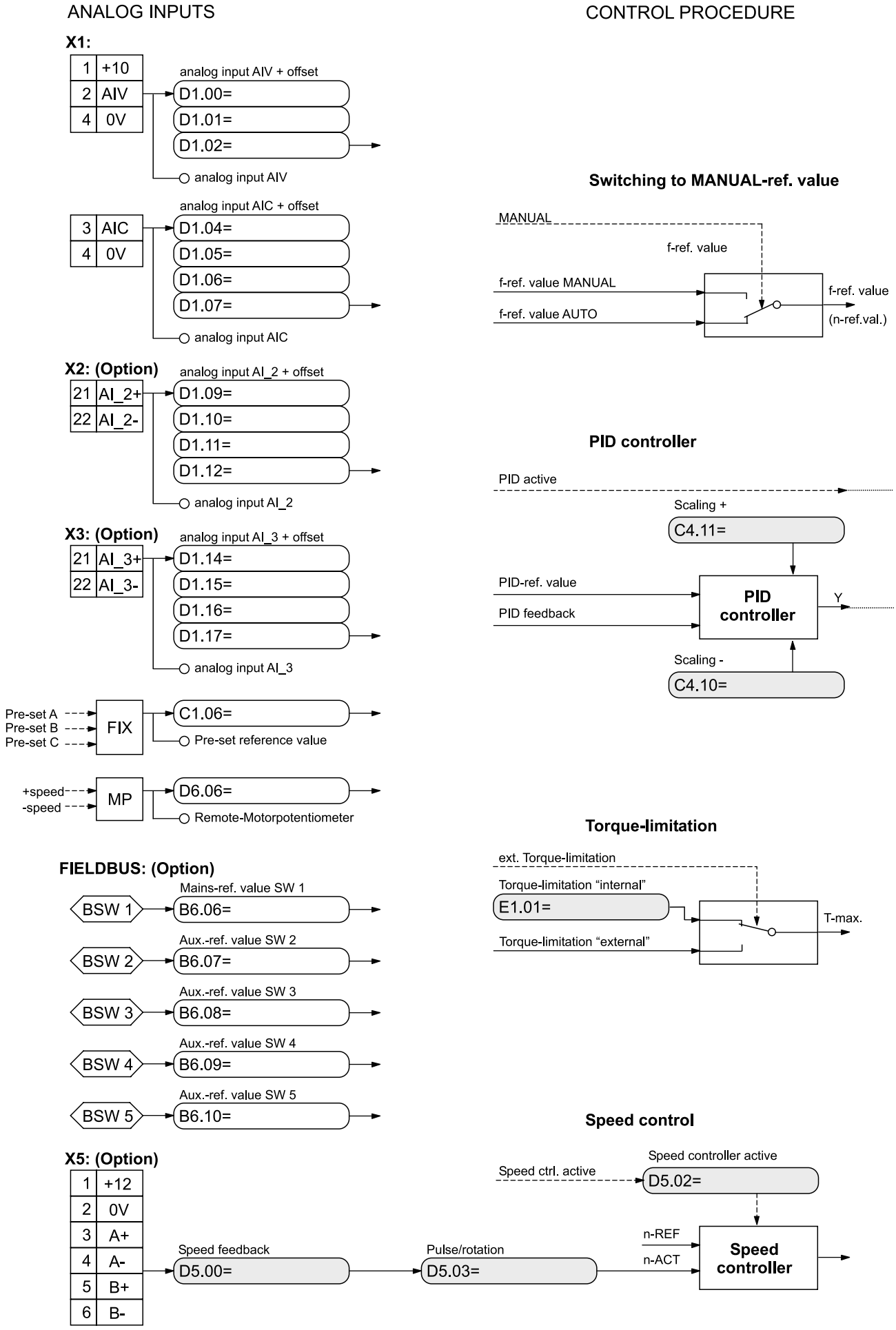
The last step is naming the file.
If you are writing to the chip, you can select a bin-file from the subdirectory \PUBLIC. If you are reading, you can enter any filename you like.
Make sure that you do not overwrite one of your bin-files by mistake.

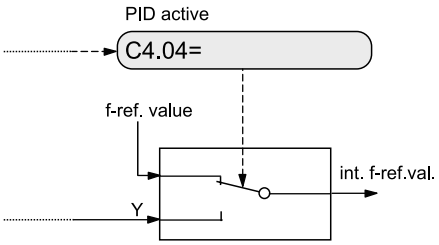
Files containing FLASH programs must have the file extension .bin. All *.bin files are stored in the subdirectory \PUBLIC. Other *.bin files can also be copied into this directory manually, if required.

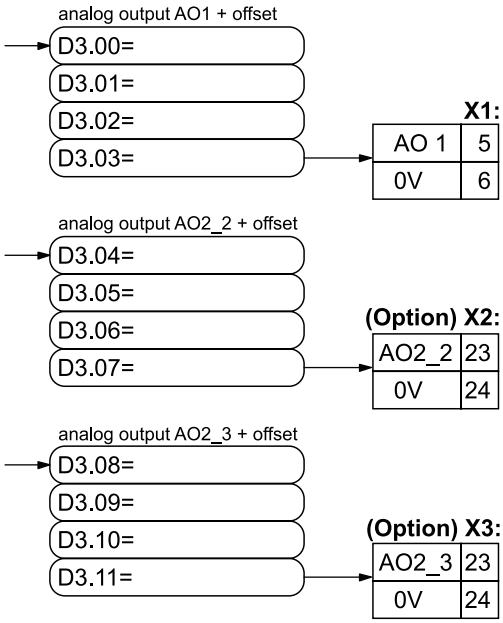
In the event of an interruption during the data transfer to the inverter, switch off the inverter, press and hold the key "Matrix/Para" when you switch it on again. The yellow Ready-LED flashes. Now the *>pDRIVE< MX* is ready for a renewed data transfer.

If you transmit data with FLASHcopy, all motor data and autotuning values are transmitted, too. Therefore, only use this function observing the additional remarks in the *>pDRIVE< MX* service instruction !

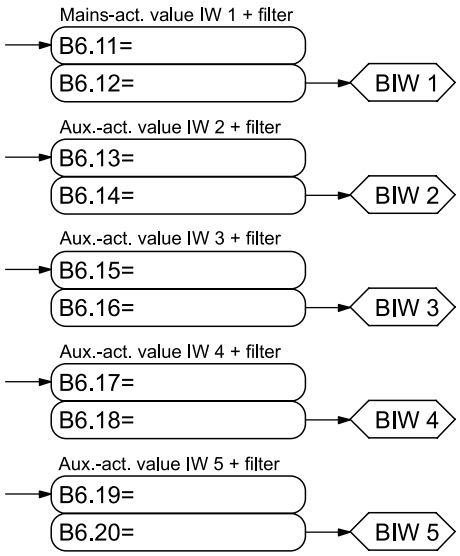
Schematic diagram 1:

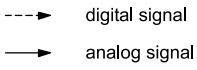




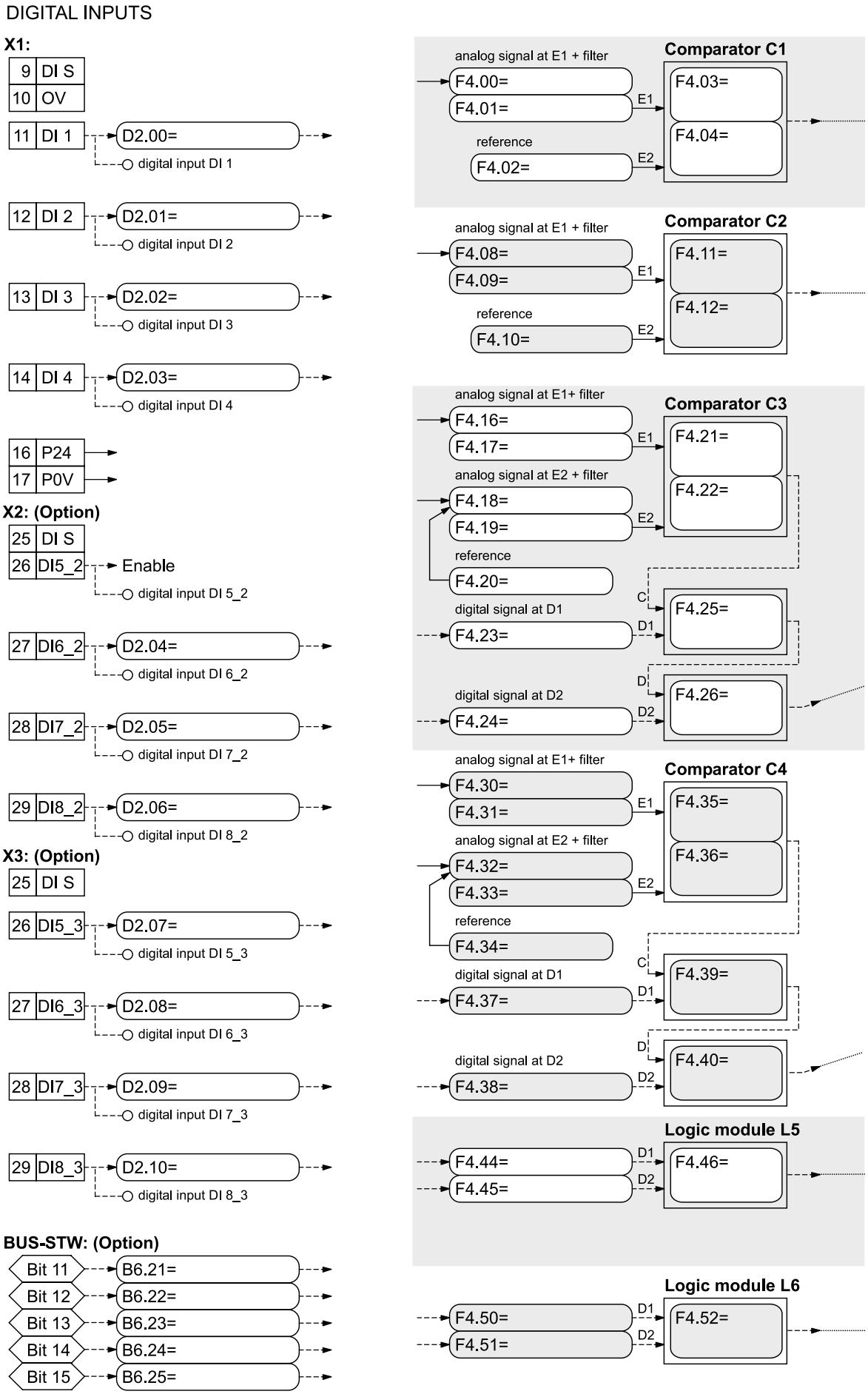


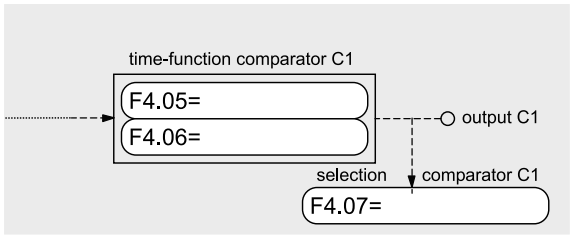
(Option) FIELDBUS:

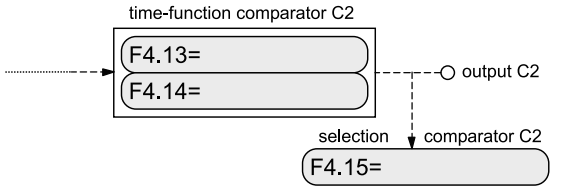


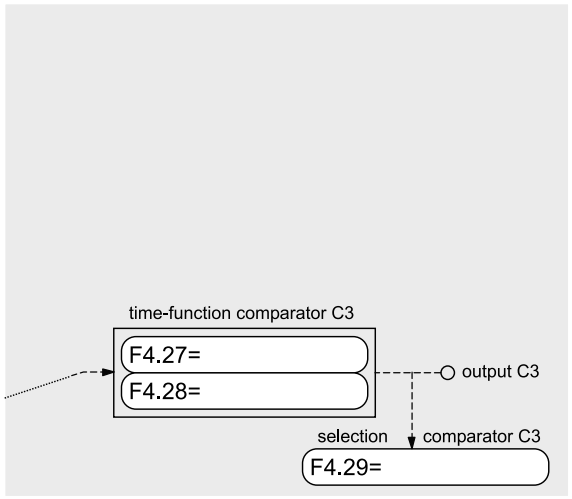


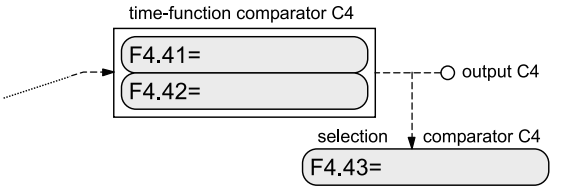
Schematic diagram 2:

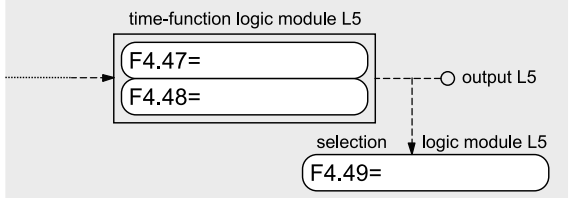


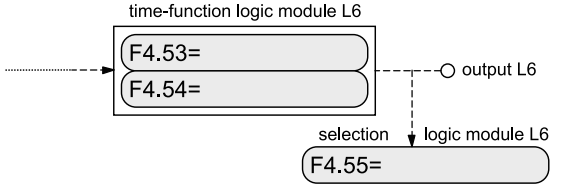

time-function comparator C1
F4.05=
F4.06=
output C1
selection
comparator C1
F4.07=

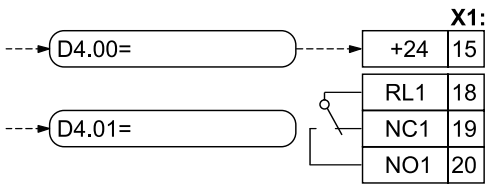

time-function comparator C2
F4.13=
F4.14=
output C2
selection
comparator C2
F4.15=

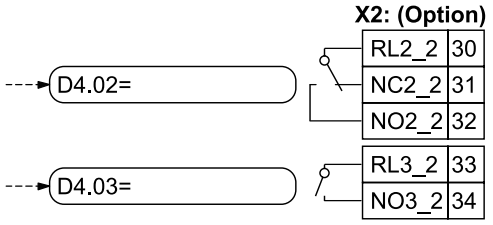

time-function comparator C3
F4.27=
F4.28=
output C3
selection
comparator C3
F4.29=

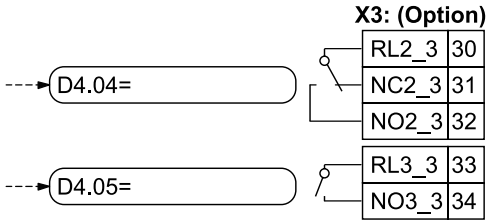

time-function comparator C4
F4.41=
F4.42=
output C4
selection
comparator C4
F4.43=

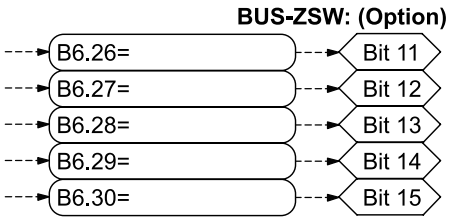

time-function logic module L5
F4.47=
F4.48=
output L5
selection
logic module L5
F4.49=

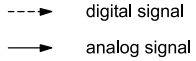

time-function logic module L6
F4.53=
F4.54=
output L6
selection
logic module L6
F4.55=


X1:
D4.00=
+24
15
D4.01=
RL1
18
NC1
19
NO1
20


X2: (Option)
D4.02=
RL2_2
30
NC2_2
31
NO2_2
32
D4.03=
RL3_2
33
NO3_2
34


X3: (Option)
D4.04=
RL2_3
30
NC2_3
31
NO2_3
32
D4.05=
RL3_3
33
NO3_3
34


BUS-ZSW: (Option)
B6.26=
Bit 11
B6.27=
Bit 12
B6.28=
Bit 13
B6.29=
Bit 14
B6.30=
Bit 15


digital signal
analog signal

>pDRIVE< MX plus/top Start-up Report

General Data of the Frequency Inverter							
Voltage:	❑ 400 V	❑ 440 V	❑ 460 (480) V	❑ 500 V	❑ 690 V		
Inverter series:	❑ MX plus	❑ MX top					
Inverter type:	❑ 04	❑ 05	❑ 07	❑ 11	❑ 15/18	❑ 18/22	❑ 22/30
	❑ 30/37	❑ 37/45	❑ 45/55	❑ 55/75	❑ 75/90	❑ 90/110	❑ 110/132
	❑ 132/160	❑ 160/200	❑ 200/250	❑ 250/315	❑ 315/380	❑ 315/400	❑ 400/500
	❑ 500/630	❑ 630/800	❑ 800/1000	❑ 1000/1200	❑ 1200/1500		

Serial number:		Code:	
Customer / Company:		Supplier / Company:	
Delivery date:		Start-up date:	

Parameter settings

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
Parameter number. parameter name	Conveyor. piston pump. separator	Centrifugal pump. exhaust fan. fan	Pump with PID controller	Coiler. test bench	Special settings stored by the user	Special settings stored by the user
A2 Motor values						
A2.10 Process scaling	1.000	1.000	1.000	1.000		
A2.11 Process scaling	1.000	1.000	1.000	1.000		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
A3 Inverter values						
A3.05 Drive reference	depends on drive	depends on drive	depends on drive	depends on drive		
A3.06 Nominal current "C"	depends on drive	depends on drive	depends on drive	depends on drive		
A3.07 Hardware version	depends on drive	depends on drive	depends on drive	depends on drive		
A3.08 Software type	depends on drive	depends on drive	depends on drive	depends on drive		
A3.09 Software version	depends on drive	depends on drive	depends on drive	depends on drive		
A3.10 Serial number	depends on drive	depends on drive	depends on drive	depends on drive		
A5 Time / kWh						
A5.04 Maintenance at	0 h	0 h	0 h	0 h		
A6 Display configuration						
A6.00 Selection of zone 1	Output frequency	Output frequency	Output frequency	Output frequency		
A6.01 Selection of zone 2	Speed reference	Speed reference	Speed reference	Speed reference		
A6.02 Selection of zone 3	Motor current	Motor current	Motor current	Motor current		
A6.03 View limitations	not visible	not visible	not visible	not visible		
B1 Language selection						
B1.00 Select language	German	German	German	German		
B2 Macro configuration						
B2.00 Macro selected	*Conveyor*	*Centrifug. pump*	*Pump + PID*	*Coiler*		
B2.01 Store Usermacro UM1	Routine	Routine	Routine	Routine		
B2.02 Store Usermacro UM2	Routine	Routine	Routine	Routine		
B2.03 Macro selection	*Conveyor*	*Centrifug. pump*	*Pump + PID*	*Coiler*		
B2.04 Multi-configuration	not active	not active	not active	not active		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
B3 Motor data						
B3.00 Nominal power	depends on drive	depends on drive	depends on drive	depends on drive		
B3.01 Nominal current	depends on drive	depends on drive	depends on drive	depends on drive		
B3.02 Nominal voltage	depends on drive	depends on drive	depends on drive	depends on drive		
B3.03 Nominal frequency	depends on drive	depends on drive	depends on drive	depends on drive		
B3.04 Nominal speed	depends on drive	depends on drive	depends on drive	depends on drive		
B3.05 Line voltage	depends on drive	depends on drive	depends on drive	depends on drive		
B3.06 Operation with IR	no	no	no	no		
B3.07 Inertia J	1 kgm^2	1 kgm^2	1 kgm^2	1 kgm^2		
B3.08 Sine motor filter	not used	not used	not used	not used		
B3.09 Heating current	15 %	15 %	15 %	15 %		
B4 Auto tune						
B4.00 Start tuning	Routine	Routine	Routine	Routine		
B4.01 Rotor coefficient	depends on drive	depends on drive	depends on drive	depends on drive		
B4.02 Rotor time constant	depends on drive	depends on drive	depends on drive	depends on drive		
B4.03 Stator resistor	depends on drive	depends on drive	depends on drive	depends on drive		
B4.04 Fluxing current	depends on drive	depends on drive	depends on drive	depends on drive		
B6 Communication menu						
B6.00 Select bus	No bus	No bus	No bus	No bus		
B6.01 Select remote	Terminals	Terminals	Terminals	Terminals		
B6.02 Slave address	0	0	0	0		
B6.03 Stop mode Time out	Alarm only	Alarm only	Alarm only	Alarm only		
B6.04 Time OUT	0.0 s	0.0 s	0.0 s	0.0 s		
B6.05 ON after OFF 1.3	possible	possible	possible	possible		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
B6.06 Main-reference 1	not used	not used	not used	not used		
B6.07 Aux.-reference 2	not used	not used	not used	not used		
B6.08 Aux.-reference 3	not used	not used	not used	not used		
B6.09 Aux.-reference 4	not used	not used	not used	not used		
B6.10 Aux.-reference 5	not used	not used	not used	not used		
B6.11 Actual value 1	Output frequency	Output frequency	Output frequency	Output frequency		
B6.12 Actual 1 filter time	0.10 s	0.10 s	0.10 s	0.10 s		
B6.13 Aux. actual value 2	Speed	Speed	Speed	Speed		
B6.14 Actual 2 filter time	0.10 s	0.10 s	0.10 s	0.10 s		
B6.15 Aux. actual value 3	Output current	Output current	Output current	Output current		
B6.16 Actual 3 filter time	0.10 s	0.10 s	0.10 s	0.10 s		
B6.17 Aux. actual value 4	Torque	Torque	Torque	Torque		
B6.18 Actual 4 filter time	0.10 s	0.10 s	0.10 s	0.10 s		
B6.19 Aux. actual value 5	Power	Power	Power	Power		
B6.20 Actual 5 filter time	0.10 s	0.10 s	0.10 s	0.10 s		
B6.21 Bit 11 Control word	not used	not used	not used	not used		
B6.22 Bit 12 Control word	not used	not used	not used	not used		
B6.23 Bit 13 Control word	not used	not used	not used	not used		
B6.24 Bit 14 Control word	not used	not used	not used	not used		
B6.25 Bit 15 Control word	not used	not used	not used	not used		
B6.26 Bit 11 Status word	DI1	DI1	DI1	DI1		
B6.27 Bit 12 Status word	DI2	DI2	DI2	DI2		
B6.28 Bit 13 Status word	DI3	DI3	DI3	DI3		
B6.29 Bit 14 Status word	DI4	DI4	DI4	DI4		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
B6.30 Bit 15 Status word	DI6_2	DI6_2	DI6_2	DI6_2		
B6.34 Communicat. PPO Type	Type 2	Type 2	Type 2	Type 2		
C1 General functions						
C1.00 Increase start torque	***1 %***	0 %	0 %	***1 %***		
C1.01 Increase steady torque	10 Hz	10 Hz	10 Hz	10 Hz		
C1.02 Stop mode	Decelerat. ramp	Decelerat. ramp	Decelerat. ramp	Decelerat. ramp		
C1.03 Braking mode	no brak. function	no brak. function	no brak. function	no brak. function		
C1.04 Braking level	790 V	790 V	790 V	790 V		
C1.05 BU parallel operation	not active	not active	not active	not active		
C1.06 Preset reference select.	not used	not used	not used	not used		
C1.07 Pre-set reference 1	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.08 Pre-set reference 2	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.09 Pre-set reference 3	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.10 Pre-set reference 4	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.11 Pre-set reference 5	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.12 Pre-set reference 6	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.13 Pre-set reference 7	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.14 Pre-set reference 8	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.15 Jog frequency	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C1.16 Economy mode	not active	***Step 1***	***Step 1***	not active		
C2 Ramps						
C2.00 Acceleration ramp 1	***5.0 s***	***10.0 s***	0.0 s	***3.0 s***		
C2.01 Deceleration ramp 1	***5.0 s***	***10.0 s***	0.0 s	***3.0 s***		
C2.02 Acceleration ramp 2	20.1 s	20.1 s	20.1 s	20.1 s		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
C2.03 Deceleration ramp 2	20.1 s	20.1 s	20.1 s	20.1 s		
C2.04 S-ramp	keine Verrundung	keine Verrundung	keine Verrundung	keine Verrundung		
C2.05 S-ramp mode	Anfang + Ende	Anfang + Ende	Anfang + Ende	Anfang + Ende		
C2.06 Switch 1./2. Accelerat.	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C2.07 Switch 1./2. Decelerat.	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C2.08 Deceleration persistant f	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
C2.09 Deceleration persistant t	0.0 s	0.0 s	0.0 s	0.0 s		
C3 Speed range						
C3.00 Minimum frequency	0.00 Hz	***5.00 Hz***	***5.00 Hz***	0.00 Hz		
C3.01 Maximum frequency	***50.00 Hz***	***50.00 Hz***	***50.00 Hz***	***50.00 Hz***		
C3.02 Direction enable	***Enable FW/RV***	Disable REV	Disable REV	***Enable FW/RV***		
C3.03 Phase rotation	U-V-W / A-B-C	U-V-W / A-B-C	U-V-W / A-B-C	U-V-W / A-B-C		
C4 PID configuration						
C4.04 PID active	no	no	*yes process*	no		
C4.05 Proportional gain (kp)	0.0 %	0.0 %	***20.0 %***	0.0 %		
C4.06 Integration time (Tn)	0.00 s	0.00 s	***10.00 s***	0.00 s		
C4.07 Derive time (Tv)	0.00 s	0.00 s	0.00 s	0.00 s		
C4.08 Ref. acceleration ramp	0.0 s	0.0 s	***10.0 s***	0.0 s		
C4.09 Ref. deceleration ramp	0.0 s	0.0 s	***10.0 s***	0.0 s		
C4.10 Output scaling -	0.00 Hz	0.00 Hz	***10.00 Hz***	0.00 Hz		
C4.11 Output scaling +	0.00 Hz	0.00 Hz	***50.00 Hz***	0.00 Hz		
C5 Catch on the fly						
C5.00 Detection level	0.6 %	0.6 %	0.6 %	0.6 %		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
C6 Special functions						
C6.00 Contactor control	not active	not active	not active	not active		
C6.01 Crane function	not active	not active	not active	not active		
C6.02 Release frequency	1.7 Hz	1.7 Hz	1.7 Hz	1.7 Hz		
C6.03 Release time	0.3 s	0.3 s	0.3 s	0.3 s		
C6.04 Engage frequency	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz		
C6.05 Engage time	0.3 s	0.3 s	0.3 s	0.3 s		
C6.06 DC braking time	0.3 s	0.3 s	0.3 s	0.3 s		
C6.07 DC braking current	100 %	100 %	100 %	100 %		
C6.08 Restart delay	0.7 s	0.7 s	0.7 s	0.7 s		
C6.09 Hoist mode	no	no	no	no		
C6.10 Max (n) error	5	5	5	5		
C6.11 Fastspeed	not active	not active	not active	not active		
C6.12 T-max at f-nom	70.0 %	70.0 %	70.0 %	70.0 %		
C6.13 T-max at f-max	30.0 %	30.0 %	30.0 %	30.0 %		
C6.14 Reduction at DOWN	50.0 %	50.0 %	50.0 %	50.0 %		
D1 Analog inputs						
D1.00 AIV selection	not used	*Freq.ref.manual*	*PID reference*	not used		
D1.01 AIV value 0%	0.01 Hz	*0.00 Hz*	*0.00 Hz*	0.01 Hz		
D1.02 AIV value 100%	50.01 Hz	*50.00 Hz*	*100.00 Hz*	50.01 Hz		
D1.03 AIV filter time	0.05 s	0.05 s	0.05 s	0.05 s		
D1.04 AIC selection	*Frequ. ref. auto*	*Frequ. ref. auto*	*PID feedback*	*Frequ. ref. auto*		
D1.05 AIC level	4-20mA monitor.	4-20mA monitor.	4-20mA monitor.	4-20mA monitor.		
D1.06 AIC value 0%	*0.00 Hz*	*0.00 Hz*	*0.00 %*	*0.00 Hz*		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
D1.07 AIC value 100%	*50.00 Hz*	*50.00 Hz*	*100.00 %*	*50.00 Hz*		
D1.08 AIC filter time	0.05 s	0.05 s	0.05 s	0.05 s		
D1.09 AI_2 selection	not used	not used	not used	*Torque limit*		
D1.10 AI_2 level	0-20 mA	0-20 mA	0-20 mA	0-20 mA		
D1.11 AI_2 value 0%	0.01 Hz	0.01 Hz	0.01 Hz	*0.00 Hz*		
D1.12 AI_2 value 100%	50.01 Hz	50.01 Hz	50.01 Hz	*100.00 Hz*		
D1.13 AI_2 filter time	0.05 s	0.05 s	0.05 s	0.05 s		
D1.14 AI_3 selection	not used	not used	not used	not used		
D1.15 AI_3 level	0-20 mA	0-20 mA	0-20 mA	0-20 mA		
D1.16 AI_3 value 0%	0.01 Hz	0.01 Hz	0.01 Hz	0.01 Hz		
D1.17 AI_3 value 100%	50.01 Hz	50.01 Hz	50.01 Hz	50.01 Hz		
D1.18 AI_3 filter time	0.05 s	0.05 s	0.05 s	0.05 s		
D2 Logic inputs						
D2.00 DI1 selection	*Start FWD*	*Start FWD*	*Start FWD*	*Start FWD imp.*		
D2.01 DI2 selection	*Start REV*	*Manual (Auto)*	*PID enable*	*Start REV impuls*		
D2.02 DI3 selection	*2. ramp*	*External fault*	*External fault*	*Stop impuls*		
D2.03 DI4 selection	*External Reset*	*External Reset*	*External Reset*	*External T limit.*		
D2.04 DI6_2 selection	not used	not used	not used	*External fault*		
D2.05 DI7_2 selection	not used	not used	not used	*External Reset*		
D2.06 DI8_2 selection	not used	not used	not used	not used		
D2.07 DI5_3 selection	not used	not used	not used	not used		
D2.08 DI6_3 selection	not used	not used	not used	not used		
D2.09 DI7_3 selection	not used	not used	not used	not used		
D2.10 DI8_3 selection	not used	not used	not used	not used		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
D3 Analog outputs						
D3.00 AO1 selection	|*Outp..frequ.*|	|*Outp.frequ.*|	|*Outp.frequ.*|	|*Outp.frequ.*|		
D3.01 AO1 level	4-20 mA	4-20 mA	4-20 mA	4-20 mA		
D3.02 AO1 min. value	0 %	0 %	0 %	0 %		
D3.03 AO1 max. value	100 %	100 %	100 %	100 %		
D3.04 AO2_2 selection	not used	not used	not used	|*Torque*|		
D3.05 AO2_2 level	4-20 mA	4-20 mA	4-20 mA	4-20 mA		
D3.06 AO2_2 min. value	0 %	0 %	0 %	0 %		
D3.07 AO2_2 max. value	100 %	100 %	100 %	***150 %***		
D3.08 AO2_3 selection	not used	not used	not used	not used		
D3.09 AO2_3 level	4-20 mA	4-20 mA	4-20 mA	4-20 mA		
D3.10 AO2_3 min. value	0 %	0 %	0 %	0 %		
D3.11 AO2_3 max. value	100 %	100 %	100 %	100 %		
D4 Logic outputs						
D4.00 +24 digital output	ON (+24V)	ON (+24V)	ON (+24V)	ON (+24V)		
D4.01 Relay output 1	***Ready+ Run***	***Ready+ Run***	***Ready+ Run***	***Ready***		
D4.02 Relay output 2_2	not used	not used	not used	***Run***		
D4.03 Relay output 3_2	not used	not used	not used	***Trip***		
D4.04 Relay output 2_3	not used	not used	not used	not used		
D4.05 Relay output 3_3	not used	not used	not used	not used		
D4.06 f-Level ON	5.01 Hz	5.01 Hz	5.01 Hz	5.01 Hz		
D4.07 f-Level OFF	2.01 Hz	2.01 Hz	2.01 Hz	2.01 Hz		
D4.08 Hysteresis f=f-ref	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
D5 Encoder configuration						
D5.00 Encoder/Slipcompens.	no encoder	no encoder	no encoder	no encoder		
D5.01 Dynamic of slipcomp.	low	low	low	low		
D5.02 Speed control active	not active	not active	not active	not active		
D5.03 Pulse/rotation	1024	1024	1024	1024		
D5.04 Speed controller Kp	0.0	0.0	0.0	0.0		
D5.05 Speed controller Tn	0.00 s	0.00 s	0.00 s	0.00 s		
D5.06 Speed controller Static	0.0 %	0.0 %	0.0 %	0.0 %		
D5.07 Act. value PT1 time	0.00 s	0.00 s	0.00 s	0.00 s		
D5.08 Act. value DT1 time	0.00 s	0.00 s	0.00 s	0.00 s		
D5.09 Set value PT1 time	0.00 s	0.00 s	0.00 s	0.00 s		
D5.10 Ref. value offer. D	0.0	0.0	0.0	0.0		
D5.11 Ref. value offer. PT1	0.00 s	0.00 s	0.00 s	0.00 s		
D5.12 Load balance	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
D5.13 DMA T-controller	0.040 s	0.040 s	0.040 s	0.040 s		
D5.14 DMA K-controller	0.010	0.010	0.010	0.010		
D6 Electronic potentiometer						
D6.00 Local MP selection	Frequ. reference	Frequ. reference	Frequ. reference	Frequ. reference		
D6.01 Local MP min. value	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
D6.02 Local MP max. value	50.00 Hz	50.00 Hz	50.00 Hz	50.00 Hz		
D6.03 Local MP accel. time	10.0 s	10.0 s	10.0 s	10.0 s		
D6.04 Local MP decel. time	10.0 s	10.0 s	10.0 s	10.0 s		
D6.05 Local ref. storage	not active	not active	not active	not active		
D6.06 Remote MP selection	not used	not used	not used	not used		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
D6.07 Remote MP min. value	0.01 Hz	0.01 Hz	0.01 Hz	0.01 Hz		
D6.08 Remote MP max. value	50.01 Hz	50.01 Hz	50.01 Hz	50.01 Hz		
D6.09 Remote MP accel. time	10.0 s	10.0 s	10.0 s	10.0 s		
D6.10 Remote MP decel. time	10.0 s	10.0 s	10.0 s	10.0 s		
D6.11 Remote MP control	Terminals	Terminals	Terminals	Terminals		
D6.12 Remote ref. storage	not active	not active	not active	not active		
E1 Drive overload						
E1.00 Current max. value	150 %	*125 %*	*125 %*	150 %		
E1.01 Torque max. value	200 %	200 %	200 %	200 %		
E2 Motor protection						
E2.00 Thermistor input Activat.	*not active*	*not active*	*not active*	*not active*		
E2.01 Thermistor input Resp.	Trip	Trip	Trip	Trip		
E2.02 Motoroverload Response	Current limitation	Current limitation	Current limitation	Current limitation		
E2.03 Level of motor overload	118 %	118 %	118 %	118 %		
E2.04 I max at 0 Hz	*50 %*	31 %	31 %	*50 %*		
E2.05 I max at f nom.	*100 %*	*100 %*	*100 %*	*100 %*		
E2.06 Therm. f-limitation	30 Hz	30 Hz	30 Hz	30 Hz		
E2.07 Motor-time constant	*5 min*	*5 min*	*5 min*	*5 min*		
E2.08 Stalling time	60 s	60 s	60 s	60 s		
E2.09 Stalling frequency	5 Hz	5 Hz	5 Hz	5 Hz		
E2.10 Stalling current	80 %	80 %	80 %	80 %		
E2.11 n>> protection	Trip	Trip	Trip	Trip		
E2.12 n max motor	3200 rpm	3200 rpm	3200 rpm	3200 rpm		
E2.13 Ext. motor fault Activat.	not active	not active	not active	not active		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
E2.14 Ext. motor fault Response	Trip	Trip	Trip	Trip		
E2.15 Ext. motor flt. Time del.	1.0 s	1.0 s	1.0 s	1.0 s		
E2.16 Underload Response	not active	not active	not active	not active		
E2.17 Underload f-nom/2	15 %	15 %	15 %	15 %		
E2.18 Underload f-nom	55 %	55 %	55 %	55 %		
E2.19 Underload PID error	50 %	50 %	50 %	50 %		
E2.20 Underload start time	10.0 s	10.0 s	10.0 s	10.0 s		
E2.21 Underload filter time	3.0 s	3.0 s	3.0 s	3.0 s		
E3 Fault configuration						
E3.00 Autorestart	not active	not active	not active	not active		
E3.01 Local reset	active	active	active	active		
E3.02 Reaction at trip	Free wheel	Free wheel	Free wheel	Free wheel		
E3.03 Loss of 4mA Activation	not active	not active	not active	not active		
E3.04 Loss of 4mA Response	Trip	Trip	Trip	Trip		
E3.05 Loss of 4mA fixed frequ.	10.00 Hz	10.00 Hz	10.00 Hz	10.00 Hz		
E3.06 BR overload Response	not active	not active	not active	not active		
E3.07 BR continuous power	1.0 kW	1.0 kW	1.0 kW	1.0 kW		
E3.08 BR Ohm value	10.0 Ohm	10.0 Ohm	10.0 Ohm	10.0 Ohm		
E3.09 Ext. BS fault Activation	N.O. Ready+Run	N.O. Ready+Run	N.O. Ready+Run	N.O. Ready+Run		
E3.10 Ext. BS fault time delay	5.0 s	5.0 s	5.0 s	5.0 s		
E3.11 External fault Activation	not active	*N.O. Ready+Run*	*N.O. Ready+Run*	*N.O. Ready+Run*		
E3.12 External fault Response	Trip	Trip	Trip	Trip		
E3.13 External fault time delay	0.0 s	0.0 s	0.0 s	0.0 s		
E3.14 Process fault Activation	not active	not active	not active	not active		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
E3.15 Process fault Response	Trip	Trip	Trip	Trip		
E3.16 Process fault t1 delay	0.0 s	0.0 s	0.0 s	0.0 s		
E3.17 Process fault t2 delay	0.0 s	0.0 s	0.0 s	0.0 s		
E3.18 Insulation fault Activat.	not active	not active	not active	not active		
E3.19 Insulation fault Response	Trip	Trip	Trip	Trip		
E3.20 Insulation flt. time delay	10.0 s	10.0 s	10.0 s	10.0 s		
E3.21 Undervoltage Response	not active	not active	not active	not active		
E3.22 Undervoltage time delay	2.0 s	2.0 s	2.0 s	2.0 s		
E3.23 Inverter Temp. Response	I-limit to 50 %	I-limit to 50 %	I-limit to 50 %	I-limit to 50 %		
E4 Control configuration						
E4.00 Local/Remote reference	Local/Remote	Local/Remote	Local/Remote	Local/Remote		
E4.01 Local/Remote control	Local/Remote	Local/Remote	Local/Remote	Local/Remote		
E4.02 Local/Remote switch	Keypad	Keypad	Keypad	Keypad		
E4.03 Control mode local	Keypad	Keypad	Keypad	Keypad		
E4.04 Local STOP key	Local active only	Local active only	Local active only	Local active only		
E5 Skip frequency						
E5.00 Skip frequency 1	5.00 Hz	5.00 Hz	5.00 Hz	5.00 Hz		
E5.01 Hysteresis 1	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
E5.02 Skip frequency 2	25.00 Hz	25.00 Hz	25.00 Hz	25.00 Hz		
E5.03 Hysteresis 2	0.00 Hz	0.00 Hz	0.00 Hz	0.00 Hz		
E6 Switching frequency						
E6.00 Min. switching frequency	2.5 kHz	2.5 kHz	2.5 kHz	2.5 kHz		
E6.01 Max. switching frequency	2.5 kHz	2.5 kHz	2.5 kHz	2.5 kHz		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
F1 Test-Help						
F1.00 Test power part	Routine	Routine	Routine	Routine		
F1.01 Test control part	Routine	Routine	Routine	Routine		
F2 Factory settings						
F2.00 Return factory applicat.	Routine	Routine	Routine	Routine		
F2.01 Return factory motor	Routine	Routine	Routine	Routine		
F3 Fault memory						
F3.01 Review	Newest event	Newest event	Newest event	Newest event		
F4 Function blocks						
F4.00 C1 signal to E1	0.0 %	0.0 %	0.0 %	0.0 %		
F4.01 C1 filter for E1	0.1 s	0.1 s	0.1 s	0.1 s		
F4.02 C1 reference	0.0 %	0.0 %	0.0 %	0.0 %		
F4.03 C1 function	E1 > E2	E1 > E2	E1 > E2	E1 > E2		
F4.04 C1 Hysteresis/Band	5.0 %	5.0 %	5.0 %	5.0 %		
F4.05 C1 time-function	ON-delay	ON-delay	ON-delay	ON-delay		
F4.06 C1 time-set	0.0 s	0.0 s	0.0 s	0.0 s		
F4.07 C1 selection	not used	not used	not used	not used		
F4.08 C2 signal to E1	0.0 %	0.0 %	0.0 %	0.0 %		
F4.09 C2 filter for E1	0.1 s	0.1 s	0.1 s	0.1 s		
F4.10 C2 reference	0.0 %	0.0 %	0.0 %	0.0 %		
F4.11 C2 function	E1 > E2	E1 > E2	E1 > E2	E1 > E2		
F4.12 C2 Hysteresis/Band	5.0 %	5.0 %	5.0 %	5.0 %		
F4.13 C2 time-function	ON-delay	ON-delay	ON-delay	ON-delay		
F4.14 C2 time-set	0.0 s	0.0 s	0.0 s	0.0 s		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
F4.15 C2 selection	not used	not used	not used	not used		
F4.16 C3 signal to E1	0.0 %	0.0 %	0.0 %	0.0 %		
F4.17 C3 filter for E1	0.1 s	0.1 s	0.1 s	0.1 s		
F4.18 C3 signal to E2	Reference value	Reference value	Reference value	Reference value		
F4.19 C3 filter for E2	0.1 s	0.1 s	0.1 s	0.1 s		
F4.20 C3 reference	0.0 %	0.0 %	0.0 %	0.0 %		
F4.21 C3 function	E1 > E2	E1 > E2	E1 > E2	E1 > E2		
F4.22 C3 Hysteresis/Band	5.0 %	5.0 %	5.0 %	5.0 %		
F4.23 C3 Input D1	State ZERO	State ZERO	State ZERO	State ZERO		
F4.24 C3 Input D2	State ZERO	State ZERO	State ZERO	State ZERO		
F4.25 C3 logic 'a' function	OR	OR	OR	OR		
F4.26 C3 logic 'b' function	OR	OR	OR	OR		
F4.27 C3 time-function	ON-delay	ON-delay	ON-delay	ON-delay		
F4.28 C3 time-set	0.0 s	0.0 s	0.0 s	0.0 s		
F4.29 C3 selection	not used	not used	not used	not used		
F4.30 C4 signal to E1	0.0 %	0.0 %	0.0 %	0.0 %		
F4.31 C4 filter for E1	0.1 s	0.1 s	0.1 s	0.1 s		
F4.32 C4 signal to E2	Reference value	Reference value	Reference value	Reference value		
F4.33 C4 filter for E2	0.1 s	0.1 s	0.1 s	0.1 s		
F4.34 C4 reference	0.0 %	0.0 %	0.0 %	0.0 %		
F4.35 C4 function	E1 > E2	E1 > E2	E1 > E2	E1 > E2		
F4.36 C4 Hysteresis/Band	5.0 %	5.0 %	5.0 %	5.0 %		
F4.37 C4 Input D1	State ZERO	State ZERO	State ZERO	State ZERO		
F4.38 C4 Input D2	State ZERO	State ZERO	State ZERO	State ZERO		
F4.39 C4 logic 'a' function	OR	OR	OR	OR		
F4.40 C4 logic 'b' function	OR	OR	OR	OR		

Parameter	Macro M1	Macro M2	Macro M3	Macro M4	User Macro UM1	User Macro UM2
F4.41 C4 time-function	ON-delay	ON-delay	ON-delay	ON-delay		
F4.42 C4 time-set	0.0 s	0.0 s	0.0 s	0.0 s		
F4.43 C4 selection	not used	not used	not used	not used		
F4.44 L5 signal to D1	State ZERO	State ZERO	State ZERO	State ZERO		
F4.45 L5 signal to D2	State ZERO	State ZERO	State ZERO	State ZERO		
F4.46 L5 logic function	OR	OR	OR	OR		
F4.47 L5 time-function	ON-delay	ON-delay	ON-delay	ON-delay		
F4.48 L5 time-set	0.0 s	0.0 s	0.0 s	0.0 s		
F4.49 L5 selection	not used	not used	not used	not used		
F4.50 L6 signal to D1	State ZERO	State ZERO	State ZERO	State ZERO		
F4.51 L6 signal to D2	State ZERO	State ZERO	State ZERO	State ZERO		
F4.52 L6 logic function	OR	OR	OR	OR		
F4.53 L6 time-function	ON-delay	ON-delay	ON-delay	ON-delay		
F4.54 L6 time-set	0.0 s	0.0 s	0.0 s	0.0 s		
F4.55 L6 selection	not used	not used	not used	not used		
F6 Code lock						
F6.00 Code	0	0	0	0		
F6.01 Code value	0	0	0	0		
F6.02 Parameter-Access	Keypad	Keypad	Keypad	Keypad		
F6.03 Pulse inhibit	No	No	No	No		

Data stored into the USER macro ?

❑ yes

❑ no

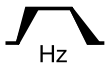
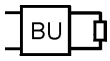
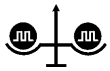
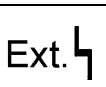
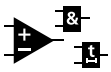
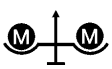
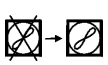
Commissioned by: _____

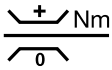
Date: _____

Signature: _____

Notes:

Index of Functions

Special functions		Description	Page
2nd Parameterset		Switch-over of the whole parameter set (e.g. for 2 different motors).	22, 29, 67
4mA Monitoring		The behavior at loss of the 4mA can be defined.	91
Acceleration/Deceleration ramps		Possibility to set the ramp time and to switch-over to 2nd ramps, S-ramp and persistant function.	46
Autorestart and Trip behavior		Adjustments for the behavior at trip.	90, 91
Braking unit and braking resistor		Control and monitoring of the braking unit *BU plus* and the connected braking resistors.	43, 45, 92
Crane function		Braking control by a digital input at hoist and trolley drives.	54
Display configuration		Adjustment of the LCD display to the desired displays and language.	19
DMA Master/Slave		Load balance of two inverters to a common load (with encoder).	77, 80
Emergency operation		Function to switch-off certain protection functions (e.g. for tunnel ventilation systems).	13, 71, 111
External fault, Process fault		Display and analysis of an external fault, process fault and insulation fault.	93, 94
Factory default		Reset of all parameters to factory default.	27, 99
Fast speed for crane applications		Speed increase at low load (e.g. for crane applications).	58
Fault memory		Record of max. 16 trips including their diagnostic values.	100
Function blocks		Comparator and logic modules to combine signals for internal or external use.	101
Line contactor control		Control of the line contactor by the inverter.	33, 53
Load balance		Load balance of several inverters to a common load (without encoder).	77, 80
Macros		Parameter default setting of the inverter corresponding to the existing application.	21, 27
Maintenance at		Alarm signal to remind of maintenance.	18

Special functions		Description	Page
Messages		Display of alarm and limitation messages, which are also provided as an digital output signal.	19, 74, A1
Motor direction		Inverting of the rotary field by a parameter without changing the wiring.	48
Motor heating		Function to prevent the motor against condensation.	25, 70
Motor overload		Adjustment of the behavior and display at overload of the motor.	87
Motor underload		Recognition and analysis of an underload.	90
Overload monitoring		Checkup of the max. reference and actual value deviation.	58
Overspeed protection		Monitoring of over-speed creating an alarm signal or a trip.	89
PID n-controller		Adjustable open-loop speed controller without encoder.	51
PID Process controller		Adjustable controller for keeping constant pressure, quantity a.s.o.	36, 49
Skip frequencies		Setting for the skip frequencies and their hysteresis.	98
Slip compensation		Keeps constant speed independent from the load (without encoder).	77
Speed control		Speed control with encoder "Closed loop".	77
Switch-over Local/Remote		Possibility to switch-over between different control sources.	9, 96
Test routines		Test of the control part und the power part.	99
Torque limitation		Limitation of the torque via parameters or analog input.	86
Undervoltage recognition		Adjustment of the behavior at mains undervoltages.	90
Usermacros		Storage of all parameter adjustments carried out. They can be called up again if necessary.	21

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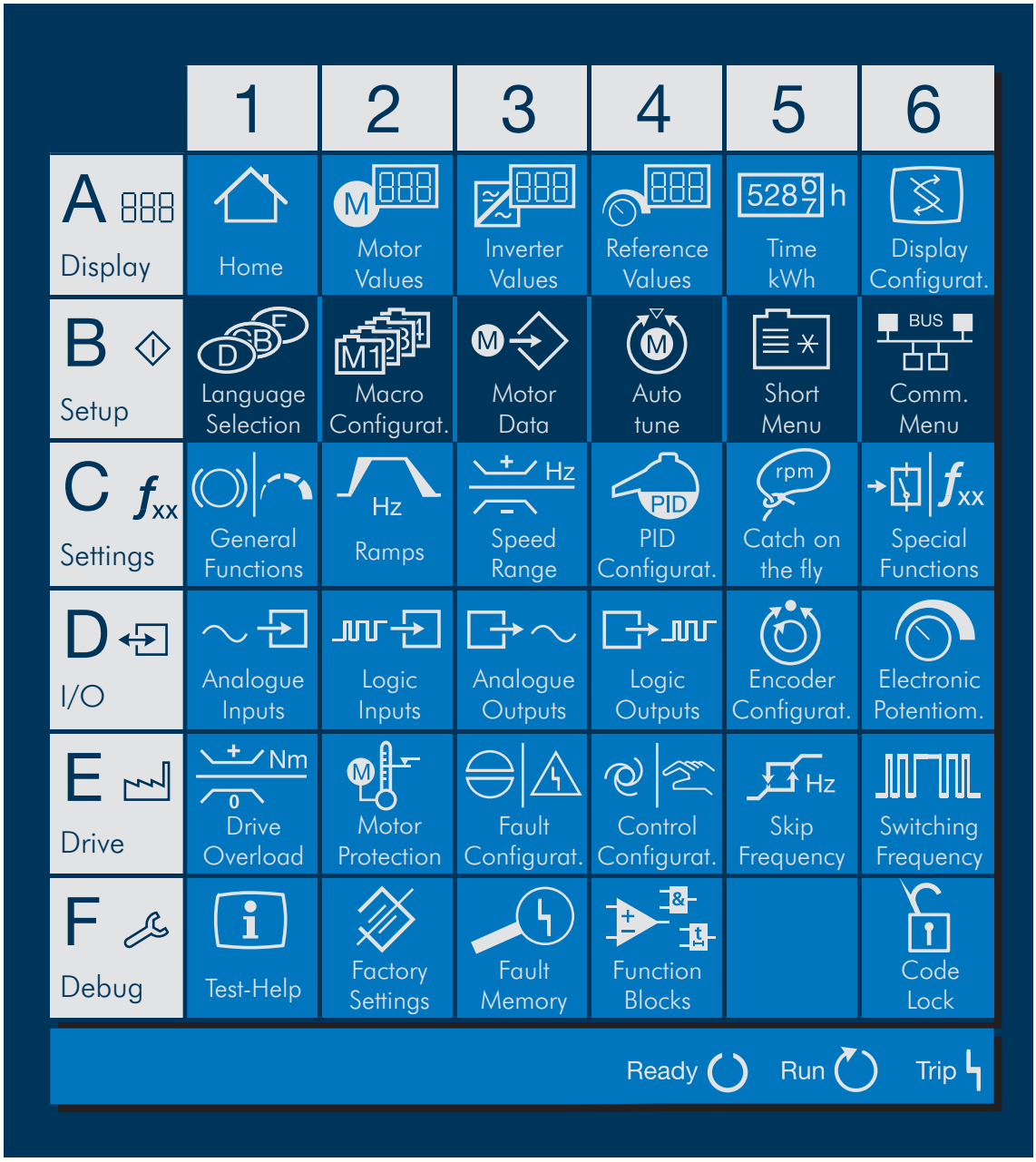

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